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MECCANO MAGAZINE

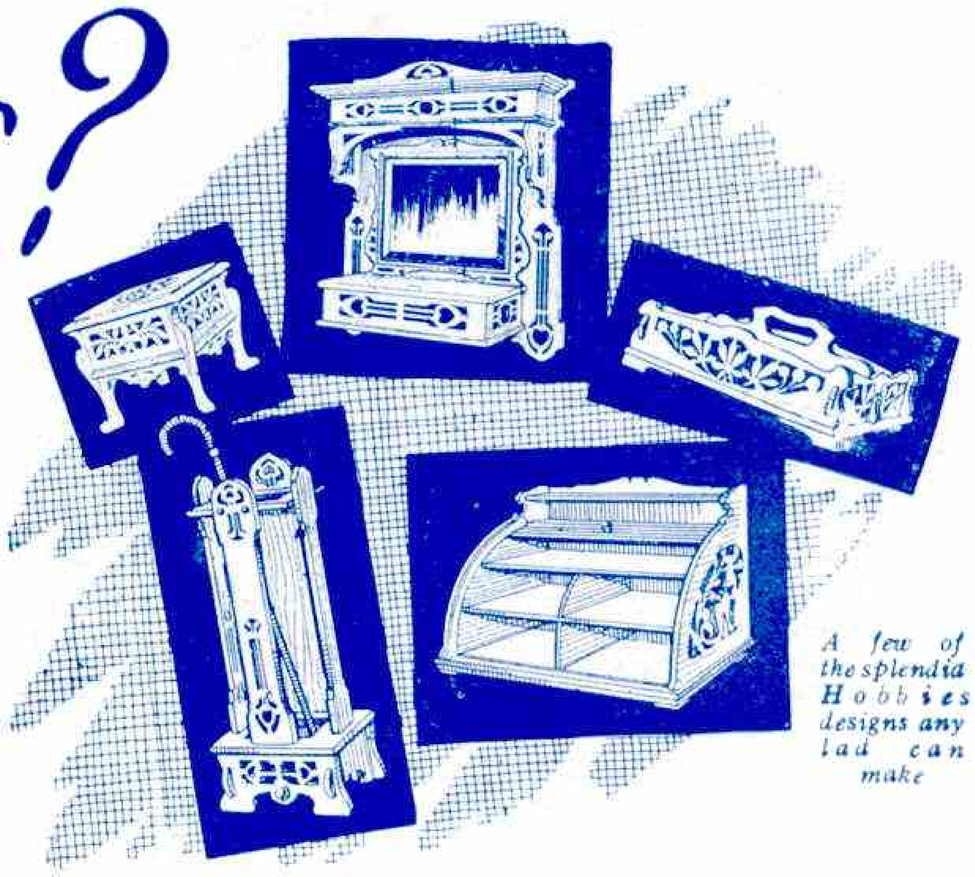
COALING SHIPS BY MACHINERY

(See page 874)

6D

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MECCANO MAGAZINE

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November, 1928

With the Editor

The Tenth Anniversary of Armistice Day

Very soon we shall all be thinking of the day in 1918 when fighting in the great World War came to an end. This year the 11th November marks the tenth anniversary of the Armistice, but in spite of the lapse of time our national Day of Remembrance has lost nothing of its appeal. The Two Minutes' Silence seems, indeed, to become more impressive year by year. There is nothing in the world quite so wonderful as this silence, because it unites the whole of the people of the British Empire in one thought at one time.

One of the most remarkable things about Armistice Day is that it has never been made into a day of wild rejoicing. In the past, the end of a great war has always brought about such outbreaks, and these were repeated on every anniversary until the event that caused them was more or less forgotten. A few isolated attempts have been made to introduce festivities, but we have come to regard Armistice Day as far too solemn an occasion for anything of this kind. Our thoughts are centred upon the millions of men who died, and upon the fervent hope that never again will the world be plunged in such an appalling disaster.

Most of my readers, of course, are too young to remember much, if anything, of the war period, and perhaps they may find it a little difficult to enter into the feelings of older folk. I should like all my younger friends to regard Armistice Day as serving a similar purpose to the "*Book of Remembrance*," of which I wrote in the September "*M.M.*" Every day a recruit of the East Kent Regiment visits the Warriors' Chapel of Canterbury Cathedral, in which the book is placed, and turns over one page—this act keeping alive the memory of 6,000 men of the regiment who lost their lives. Exactly in the same manner, the annual observation of Armistice Day will help to keep alive the memory of the boys of an earlier generation who became the heroes of the Great War and were "lost in the shadows."

"A Very Little Man, but a Giant"

On 19th November, 1828, there died in Vienna one of the most pathetically tragic figures in history—the great composer Franz Peter Schubert.

Schubert was born on 31st January, 1797. His father was a struggling schoolmaster, and it was taken for granted that Franz would follow on in the same profession. Greatly as the boy disliked and dreaded the prospect, there seemed to be no help for it, and in due course we find him leading a dreary existence as assistant to his father. He hated this work with such intensity that it was impossible for things to go on very long, and presently he made a complete break away and devoted himself entirely to music. He had no money and no prospects, but that did not worry him. He realised that his mission in life was to compose music and he went steadily on his way.

The conditions existing in Vienna at that time could scarcely have been worse from a composer's point of view. The nation was distracted with a long succession of wars and the people were ground down with taxation to such a degree that the two problems that occupied their minds were how to raise money for the taxes and, having done so, how to eke out an existence on what was left. At a time such as this people do not want music, painting, or any other art. Throughout his short life Schubert and his music were ignored in Vienna, except among a small circle of intimate friends that the composer gathered together and held round him by force of genius and personality.

From first to last Schubert lived in poverty. He never actually starved, but it was a very frequent occurrence for him to be utterly penniless and dependent for a meal upon the generosity of one of his friends. The amount of money that he received for his compositions has been very carefully calculated, and it has been placed beyond doubt that the sum total of his life's earnings was approximately £575! After his death, all his worldly belongings, including his manuscript music, realised £2–10–0.

Unspoiled by Poverty and Disappointment

The remarkable feature about Schubert was that poverty and disappointment did not sour him. If an opera on which he had placed the highest hopes was returned to him, unwanted, he simply put it away in a drawer and went on to compose something else. His publishers appeared to treat him as a goose to be plucked. In every transaction they beat him down to the lowest possible figure, and often he would be glad to sell for a few pounds a work that has since become immortal—he needed the money to buy food. On one occasion he sold a Trio for pianoforte, violin and 'cello for 17/6d.!

In spite of these heart-rending conditions, Schubert wrote ceaselessly. Ideas came to him in an almost unbroken stream and they were jotted down wherever he might be. Sometimes in a cafe, for instance, a friend would place before him a new poem, and after reading it Schubert would demand paper and pencil. Quickly someone would rule the necessary lines upon the back of a menu or any other paper that was handy, and in a few seconds Schubert would be lost to the world, composing a masterpiece.

Imagine a little man, 5 ft. 1 in. in height, fat and podgy, with a turned-up nose, and spectacles that he wore even when he was asleep—add to this a painful shyness that was a source of constant misery to him, and you have a picture of Franz Schubert. Success never came his way; he was a failure, but a splendid failure. Some of his greatest works lay hidden away in dusty cupboards until many years after his death; he himself never heard them. Yet day after day, year after year, he went on writing immortal music, impelled by the sheer driving force of his genius.

As his friend Anton Holzapfel said of him, "He was a very little man, but he was a giant."

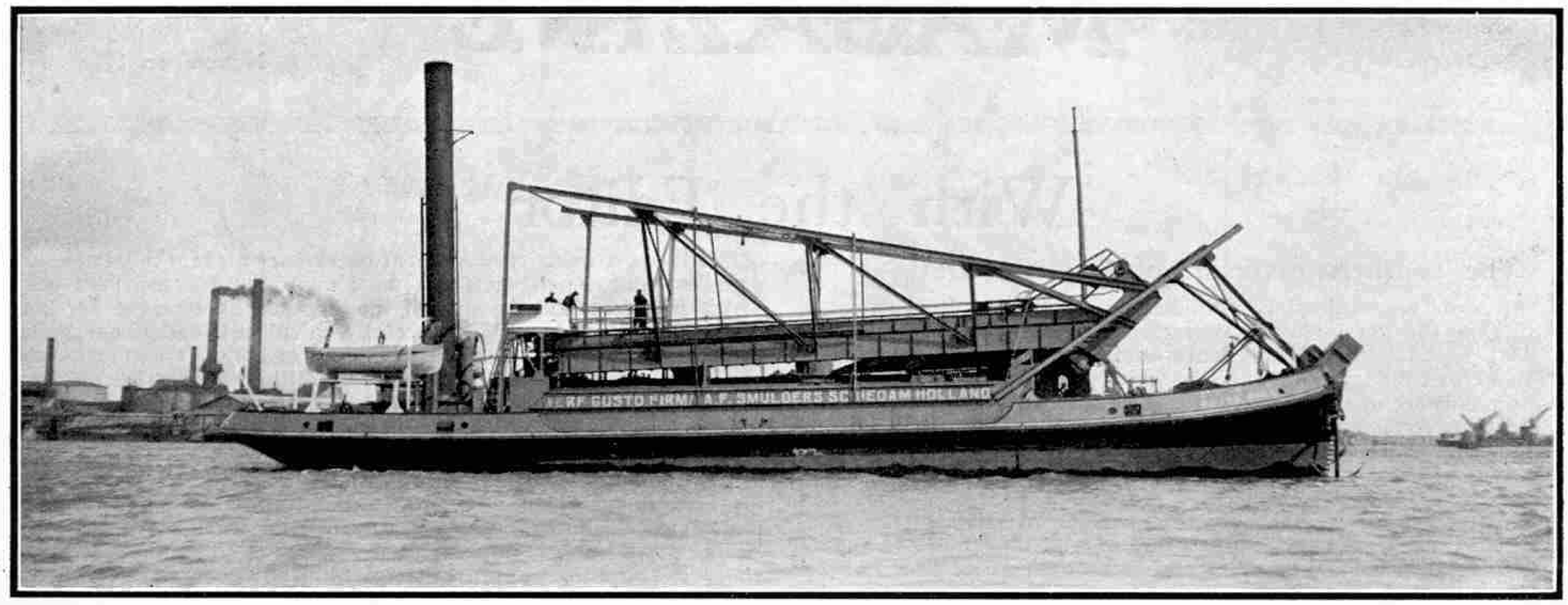
Our Special Christmas Issue

The special Christmas number of the "*M.M.*," which will consist of more than 100 pages (price 6d.) will contain a series of splendid articles in addition to the regular features. It will be, I believe, the best number ever issued, and I expect there will be a greatly increased demand for it as was the case with the Christmas issue of last year. Although at least 75,000 copies will be printed, readers will be well advised to place an order for a copy at once with their Meccano dealer or newsagent. Unless readers order their copies well in advance there certainly will be many disappointments.

I have in hand a number of exceptionally interesting special articles that will appear in the December and subsequent issues. Among these may be mentioned the following, which will give an idea of the wide range:—"Early Railway Days in Canada"; "Life-Story of a Great Bell"; "Laying a Telephone Cable Across the Baltic"; "Photography by Invisible Rays"; "Dials of some Famous Clocks"; "Simple Conjuring Tricks"; "Aeroplane Landing Grounds in the Atlantic." I am also commencing a series of articles on "New Meccano Parts and How to Use Them." These articles will be of special interest to all Meccano boys and will be found of very considerable assistance in model-building.

Coaling Ships by Machinery

Elevator that Handles 1,000 Tons per Hour



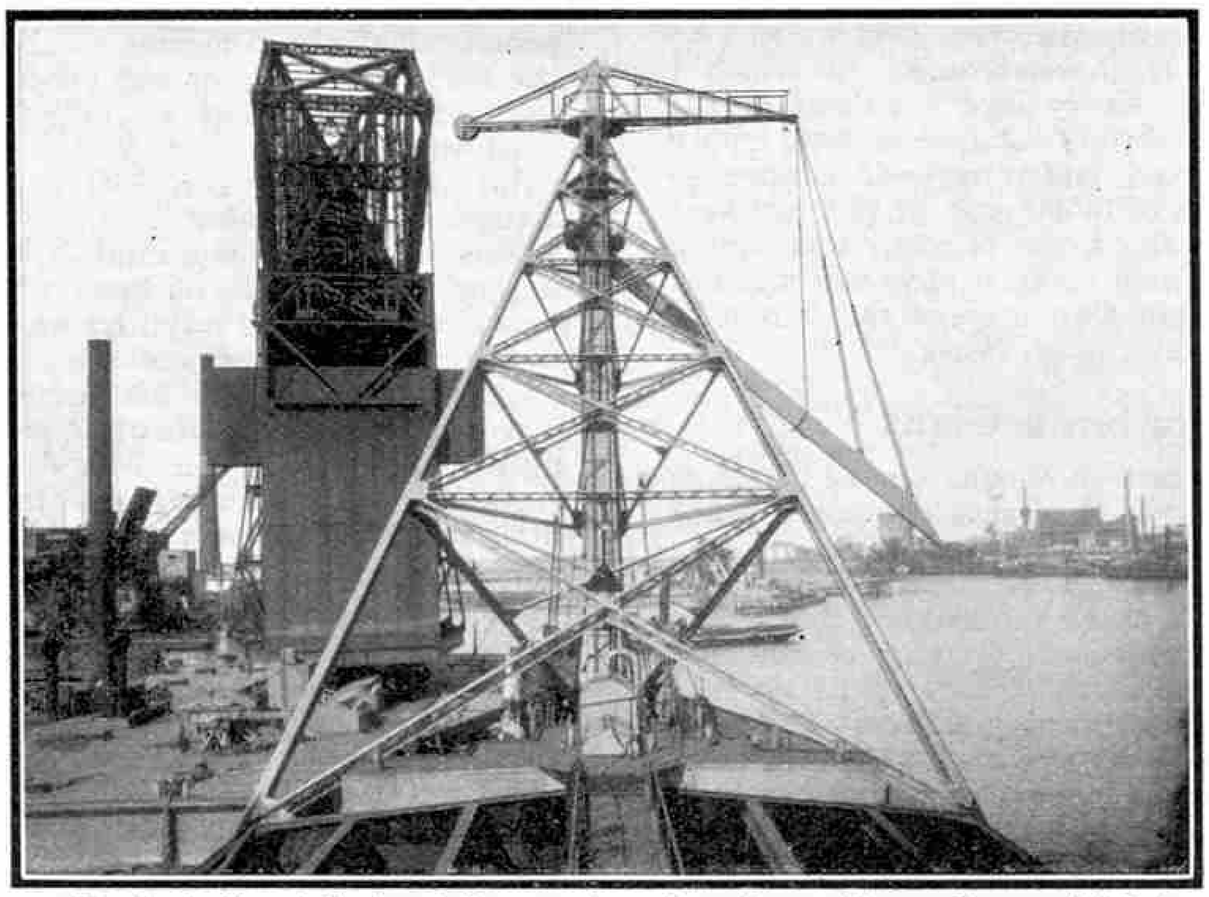
IN the early days of steamships coaling was carried out entirely by hand labour. This process was laborious and slow, but the early steamships were so small and required so little coal that these drawbacks were not serious. As the size of steamships increased, however, the coaling problem became more and more acute. By degrees various mechanical appliances were brought into use to speed up the operations, and these have been improved and developed until to-day coaling by hand has been almost entirely abandoned, existing only in a few parts of the world where there is an ample and cheap supply of native labour.

It is interesting to look back to the time when engineers and scientific men were strongly divided in opinion as to whether it was possible for a vessel to carry a sufficient supply of coal to enable her to cross the Atlantic. The famous engineer I. K. Brunel does not appear to have ever had the slightest doubt that such a voyage was possible, but his views were strongly opposed in many quarters and in particular by a certain Dr. Dionysius Lardner who, at that time, was a prominent figure in the scientific world.

Speaking at a meeting of the British Association held at Bristol in 1836, Lardner expressed his opinions very emphatically. "Let them take a vessel of 1,600 tons," he said, "provided with 400 horse-power engines. They must take 2 tons for each horse-power, the vessel must have 1,348 tons of coal, and to that add 400 tons, and the vessel must carry a burden of 1,748 tons. He thought it would be a waste of time, under all the circumstances, to say much more to convince them of the inexpediency of attempting a direct voyage to New York, for in this case 2,080 miles was the longest run a steamer could encounter; at the end of that distance she would require a relay of coals."

Not content with this, Lardner went on to paint a melancholy picture of the terrible things that would happen on long voyages as the result of choking of smoke flues and incrustation of boilers!

Lardner's statements undoubtedly made a considerable impression at the time, but not on Brunel. With characteristic impetuosity this brilliant engineer made it quite clear that he did not attach the slightest importance to Lardner's views on this or any other subject, and he steadily went on with his schemes. His boldness and enthusiasm won over to his side many engineers and financiers who previously had wavered, and the result was that the "*Sirius*" and the "*Great Western*" were built and proved beyond doubt that steamships could carry a sufficient supply of coal to enable them to cross the Atlantic. These two vessels may be regarded as having inaugurated large-scale coaling operations.



The illustration at the top of the page shows the self-propelling coaling vessel "Bujun Maru," built in Holland for a Japanese company. The vessel is illustrated with the ladder, crane and delivery chute dismantled for the voyage.

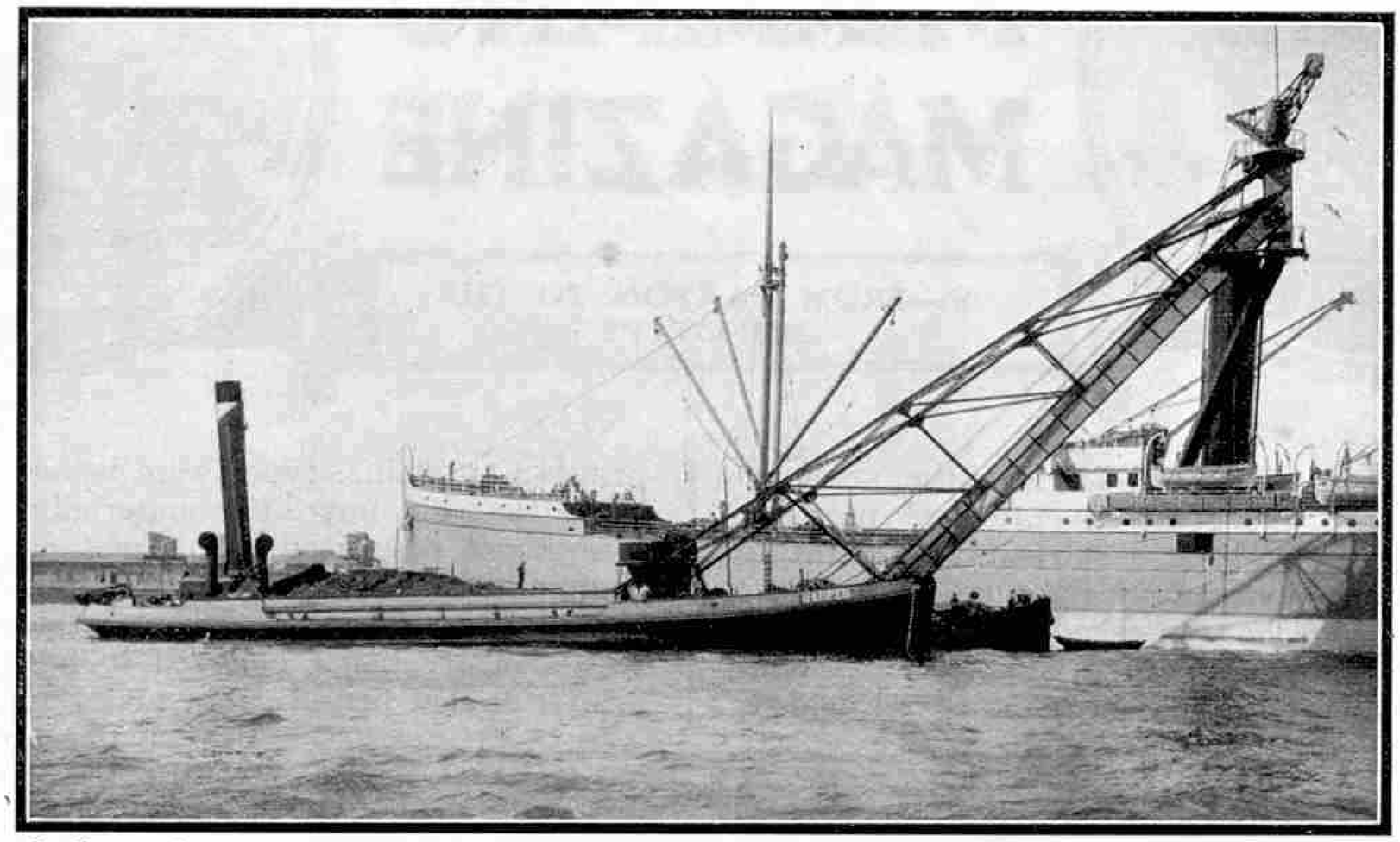
The lower illustration shows the ladder, crane and chute in position, as viewed from the navigating bridge. For this and other photographs illustrating this article we are indebted to Werf Gusto, Firma A. F. Smulders, Schiedam, Holland, the builders of this vessel.

From a coaling point of view, one of the most extraordinary episodes on record was the Atlantic crossing in 1836 of the paddle steamer "*Royal William.*" This vessel belonged to the City of Dublin Steam Packet Company, and had been built for the Liverpool-Kingstown service. Consequently her coal storage capacity was quite small and, in order to make room for the additional amount of coal that would be required to cross the Atlantic, her passenger accommodation had to be reduced from 80 to 32, her cargo space eliminated entirely, and various deck fittings removed.

When the coaling operations were complete the "*Royal William*" must have presented a really astounding sight. According to Kennedy's "*History of Steam Navigation,*" "coal filled her bunkers, her holds, and even her well-deck, so that her paddles were buried six feet, her sponsons were submerged, and it was possible, by

leaning over the bulwarks, to wash one's hands in the water that surged at the vessel's sides." Later, vessels designed for ocean travel were provided with adequate bunkers where the coal was effectually shut off from the passengers' quarters and the cargo holds, and coaling became a more systematic operation.

As we have already stated, coaling by hand to-day is only economically possible where cheap native labour is available, and this state of affairs is confined mainly to certain Eastern ports. The process is inevitably dirty and causes intense discomfort to all on board the ship. The clouds of coal-dust that rise up and envelop the ship penetrate into every nook and corner in spite of all precautions, and it is a tremendous relief when the task is over and the ship once more puts out to sea.



Coaling a large vessel. Note how the delivery chute extends over the deck and passes directly to the bunkers

Except in such ports as these, coaling is carried out entirely or almost entirely by mechanical means. The actual methods and mechanism employed vary in different ports according to local conditions and the number and size of the ships that have to be supplied. Naturally the most elaborate and most interesting machinery is to be found at the larger ports.

At Liverpool, for instance, the equipment available for shipping includes a whole fleet of floating coaling machines. These machines are of two types, one operated by grab in conjunction with a belt conveyor, and the other by means of a bucket elevator and chute.

In the case of the former type the machine is moored alongside the vessel to be coaled and a barge laden with coal is brought alongside the machine. The grab then descends swiftly into the barge and its great steel jaws close upon a mouthful of coal weighing more than a ton. It is then drawn up and releases its coal upon a travelling belt conveyor that carries it across the deck of the ship and deposits it through the open hatchway of the coal bunker. While the conveyor is transporting the coal in this manner the grab descends again to the barge for another load. The grab can coal a ship at the rate of more than 100 tons per hour, each barge as it is emptied being replaced by a full one.



The "*Bujun Maru*" in action. This photograph gives an excellent idea of the ease and speed with which huge quantities of coal can be dealt with

In the case of the machines operated by bucket elevator and chute, the coal is not brought alongside in barges but is carried on the machines themselves, some of which can accommodate 1,100 tons. The coal is made to fall in regulated quantities through a false bottom on to a travelling chain of buckets that hoist it to the top of the machine and discharge it down long chutes extending over the decks into hatchways, or alternatively into the side ports of the ship's bunkers. These machines are capable of coaling a vessel at the rate of about three hundred tons per hour.

Some of the most successful ship-coaling machines have been constructed by Werf Gusto, Firma A. F. Smulders, of Schiedam, near Rotterdam, to whom we are indebted for much of our information. The remarkable coaling elevator shown on the cover of this issue of the "*M.M.*" was built by this company. The illustration gives a very good idea of the construction of the machine and of the purpose of the various principal parts. It will be noted that it is of the pontoon type and is a combination of a bucket elevator and a coaling vessel.

The superstructure carried by the pontoon includes the engine house, the control cabin, and the two massive mechanical arms that give the machine its distinctive appearance. One of these arms receives coal from a barge alongside and the other delivers it into the bunkers of the ship. The chief feature of the receiving arm, seen on the left of the cover illustration, is the huge vertical swinging ladder suspended directly over the loaded barge.

The coal is taken out of the barge by means of an endless chain of buckets that pass empty down the outer side of the ladder, fill themselves, and ascend the inner side. At the top of the ladder the chain is diverted to an almost horizontal direction of travel and as the loaded buckets pass along they empty part of their contents into a channel immediately beneath them. The coal is pushed forward in this channel by the buckets until it finally enters a large hopper and at this stage the buckets empty themselves completely and return along an upper path to the ladder.

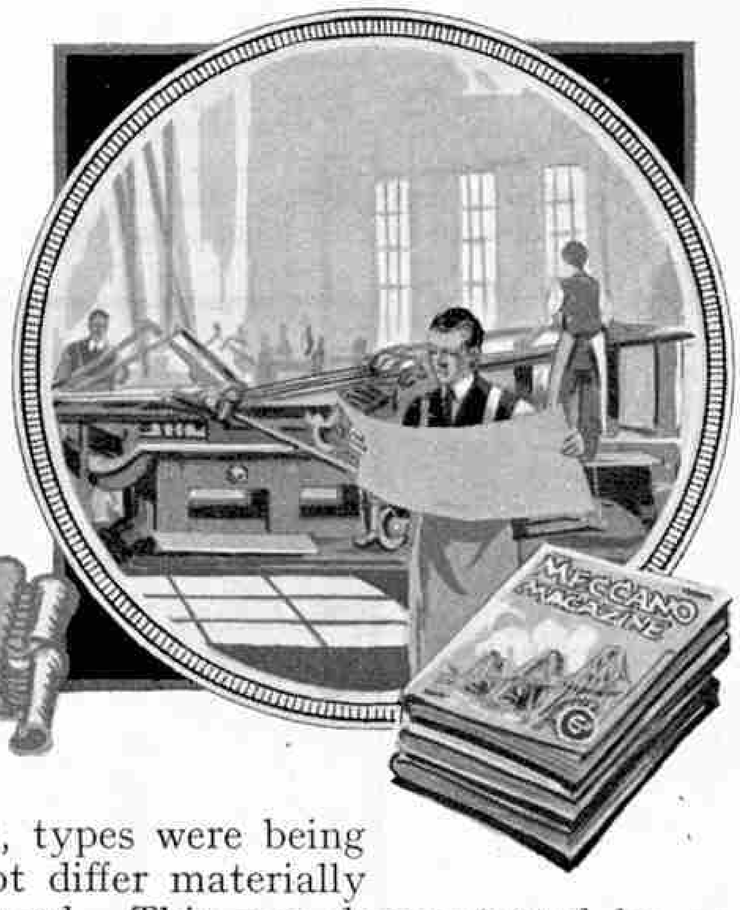
When coal has to be discharged into the holds of a collier it can be transferred at almost pontoon deck level. It is allowed to gravitate from the hopper on to an endless conveyor belt that is supported by and travels along the upper side of a skeleton framework extending from the elevator to the hold of the ship. It is then caused to drop into the hold by the belt passing round the extremity of the arm and returning along the under side to the pontoon.

If the coal received in the hopper is intended for the bunkers of a large liner it is picked up by another series of buckets that carry it up along an inclined ladder. Before the loaded buckets reach the ladder they pass over the platform of a weighing machine that is guaranteed to weigh accurately within one per cent. with a list on the ship up to 10 degrees, or with the vessel down by the head or the stern to the same extent. As a matter of fact tests have shown that the accuracy of the weighing machine, which bears the official stamp of the British Board of Trade, is greater than 10 degrees. An automatic recording device is provided for indicating continuously the total quantity of coal that has been transferred from the hopper.

At the top of the ladder the buckets empty (*Continued on page* 887)



Producing the MECCANO MAGAZINE



V.—FROM CAXTON TO THE MONOTYPE

LAST month we told the story of the great invention of movable types by Gutenberg. We also showed how printing helped William Caxton to supply the number of copies of his books for which he was asked. This led him to set up a press in his own country, and by the end of the 15th century the art had spread, not only to England, but throughout the greater part of Europe. The movement began in 1462, during a war between two rivals for the vacant Archbishopric of Mainz. The city was sacked during the struggle and it is said that Gutenberg's house and printing establishment were burned. Many of the inventor's workmen fled to other German towns, and even further afield, and carried knowledge of his methods with them.

During the following centuries printing became more and more important and improvements were continually necessary in order to enable printers to meet the growing demand for their products. The greatest progress was made after the application of steam power during last century. Many wonderful machines are now in daily use, with the aid of which type may be cast and actual printing performed at an amazing speed. The development of these machines from the simple methods employed by Gutenberg forms an interesting story.

It seems very probable that the first movable types used in Europe were cut out in wood. This would be quite natural, for the inventor must have been familiar with the use of wood in block-printing and would be likely at first to use the same material. Gutenberg is said to have used wooden types in printing his first Bible, and various people have stated that they have actually seen types of this kind that had belonged to Johann Fust of Mainz. These types were said to be still in existence in a worm-eaten condition up to as late as 1771.

The use of wooden types was followed by the introduction of metal, at first engraved and later cast; and by 1470, only 16 years after the introduction of printing at Mainz, types were being made that did not differ materially from those now used. This was demonstrated by an examination of some old type fished up from the bed of the River Saone at Lyons, opposite the site of a 15th century house believed to have been used by a printer of that period. The metal used for casting type also may have been similar to that used at the present day. From a cost book of a printer of about 1480 it is clear that steel, brass, copper, tin, lead and iron wire were used in the manufacture of type, and the casting probably was done either in clay or sand.



How books were produced before printing. A scribe at work on a large manuscript

Type-metal is an alloy of which lead is the chief constituent on account of its ductility and malleability. Other constituents are antimony, tin and copper. Antimony gives hardness and copper increases toughness, while tin is used to give a sharp face to the type. The early printers made their own types, but type-founding is now a separate craft.

The earliest methods used in making types involved the preparations of a punch and a matrix. The punch was a steel bar two inches in length on the end of which a letter was engraved. Its preparation required great accuracy and it was frequently tested with the gauge during manufacture. Finally it was hardened and driven into a piece of polished copper. The impression made in the copper was then carefully worked upon until its width and depth were of standard size. The name "matrix" was given to the impression thus produced, and it was used for casting the type, the body of which was formed by the use of a mould.

Typecasting in the early days of the trade was performed entirely by hand, and was consequently a slow process. The woodcut on page 789 of last month's "*M.M.*" shows how it was formerly carried out. The mould consisted mainly of two steel members, which formed a cavity of the required shape when they were brought together. The metal parts were covered with

wood in order that the mould could be handled in comfort when full of molten metal. This was poured in from a ladle, and the expert workman instantly caused it to settle well against the matrix by giving the mould a peculiar jerk.

Attempts to produce a type-casting machine were made quite successfully. A divided mould was used, one half being attached to a part of the machine that moved on a pivot. The two parts of the mould were brought together, and the aperture was covered by the matrix, which was held in position by a strong spring. A cam action then permitted the pump to inject molten metal under pressure that caused it to fill the mould.



A busy printing works of Caxton's time. On the left are the compositors setting up copy. The screw press on the right is being used to make impressions, a boy removing the sheets as they are printed. At the back is a workman using two large pads to ink a forme

The machine was adapted for hand or power operation. The type was not delivered ready for use, but needed considerable attention in the matter of hand finishing and general sorting. This form of machine remained in general use for nearly 100 years.

Except for producing type of special kinds, all casting is now carried out on machines that are capable of producing as many as 40,000 types in a single day. In many printing establishments type-founding is actually performed by the compositor by the aid of machines that combine arrangements for casting the types and setting them up. The Monotype machine, for example, does this and, as we shall see later, the "*Meccano Magazine*" is set up upon machines of this kind.

The form of the letters on the types used by early printers is worthy of notice. The texts that they printed were mostly copied from manuscripts, many of which were written by monks who prided themselves upon the beauty of their ornamental writing. Consequently printers attempted to reproduce not only the text but also the actual forms of the letters. Thus the first Paris printer of 1470 started with types cast in imitation of the handwriting then in vogue in that city, while German printers who carried the art from Mainz into Italy cut their types in imitation of Italian manuscripts.



William Caxton (1421-1491), who set up the first English press in 1476

This imitation was in some cases carried so far as to reproduce the slightly uneven character of the lines in the manuscripts, while some printers left space for the insertion of pen-drawn initial letters in colour. In short, the idea of printing then was simply to carry out by mechanical means what previously had been done by hand.

An examination of earlier English printed works does not suggest that printing was regarded in an artistic light. Caxton's chief endeavour was to produce the best literature for the use of scholars and students, and he did not worry over headlines, title-pages or illustrations. In consequence his work cannot be fairly compared with the standard of printing throughout the rest of Europe. Better printing was achieved in England during the 16th century, but by Shakespeare's time the art had deteriorated once more. The famous first folio of Shakespeare's works was printed from small and badly worn types and the work of the compositor was carelessly done.

A great revival was brought about in 1720 by the work of William Caslon, a type-founder. He was really an engraver who had turned his attention to the cutting of type punches, and the beauty of the types for which he was responsible resulted in their general adoption. Another famous type-founder of the same century was John Baskerville, a writing master who designed types that rivalled Caslon's in popularity. Improvement in the types themselves led to greater care in the preparation and use of headings and illustrations, and to-day typography has the status of a separate art. The finest productions of the printer now compare favourably as regards beauty with the best hand-written manuscripts, and at the same time are greatly superior to them in legibility.

Now let us follow the process of the assembly of the types. This is known as composing and is carried out by a compositor who has in front of him a large case divided into two sections known respectively as the

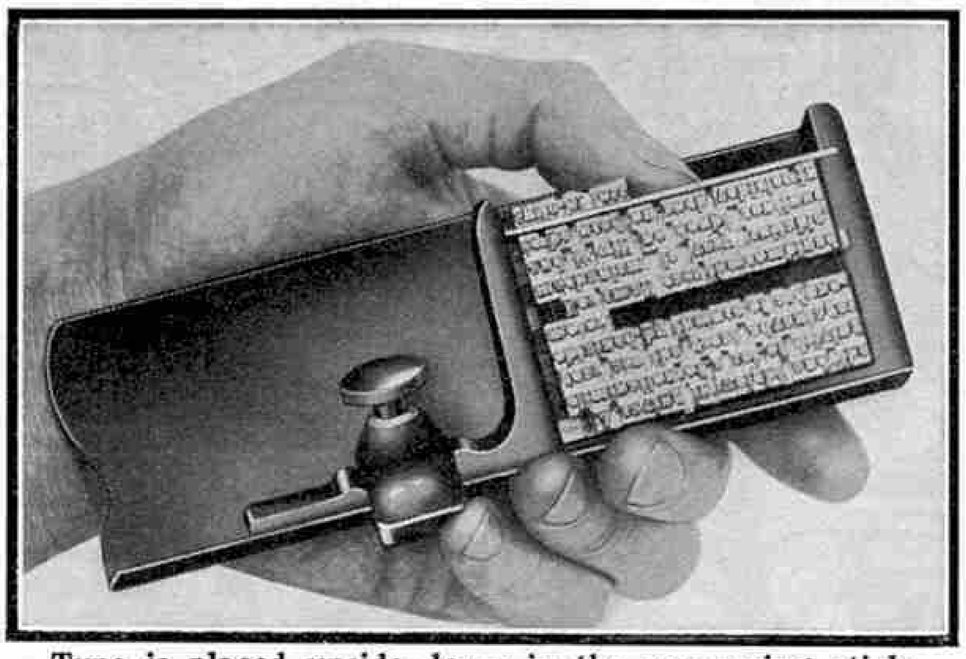
upper case and the lower case. The upper case is divided into 98 equal compartments containing principally large and small capitals. The number of compartments in the lower case is 53 and these are of various sizes, extra space being provided for those letters that occur most frequently, and of which consequently a larger number is required in the setting of ordinary matter.

The origin of the proportionate numbers of the letters found in the compositor's case is not certain, but it has been stated that calculations were made of the comparative numbers of the different letters used in the course of a long debate in the House of Commons. In any case type is sold in "founts" containing the letters in certain proportions. In one such fount, for instance, there are 14,000 e's and only 300 z's.

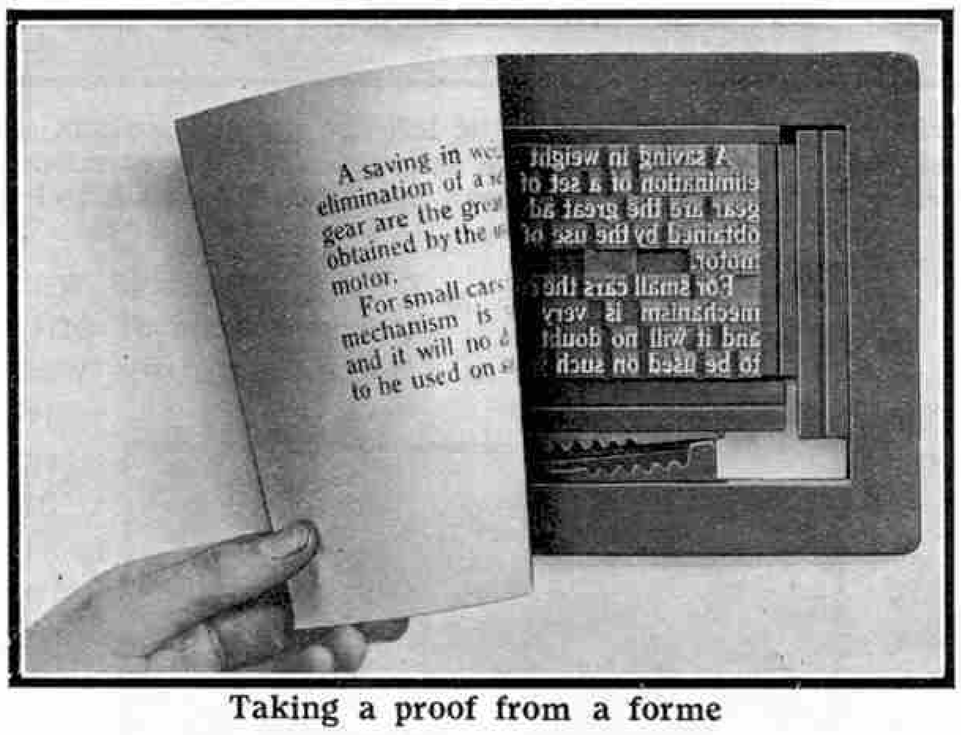
The compositor takes the types required out of the case with his right hand and arranges them in lines in the composing "stick" that he holds in his left hand. This is a metal framework large enough to hold a few lines of type. The sliding clamp is first adjusted at a distance from the fixed end equal to the length of line required and the types are then placed in position one by one, nicks on the body of these enabling the compositor to see that the letters are inserted the correct way round. When the compositor has assembled as many words as will fill a line he then "justifies" the line, that is he inserts additional or alternative "spaces" with blank faces to give the line the exact length required, as well as an even appearance that makes print easier to read than ordinary writing.

Reading from the copy to be printed, the compositor continues until he has set up as many lines as convenient. These lines are then transferred to a "galley," which is a shallow tray of steel or zinc, the sides of which are flanged to support the types. When the galley has been filled by a repetition of this process it is then fastened up and is ready for proofing and reading.

Composing seems quite simple, but it can only be done quickly and correctly after long practice. One of the difficulties met with by beginners is in reading the type in galley form, for in order to give a correct impression on paper it runs from right to left. Printers become familiar with this and read their reversed copy with ease.



Type is placed upside down in the composing stick



Taking a proof from a forme

After the necessary corrections have been carried out the type is made up into pages, and those required for printing one sheet are then assembled in a steel frame called the "chase." Spaces are left between the pages and these are filled by the insertion of rectangular pieces of wood or metal, usually described as "furniture." These pieces are below type height and make no mark on the paper, thus forming white margins around the type on printing. The whole is then locked into a compact mass by driving wedges between the chase and the furniture. In this manner is made what is known as a "forme," and it is this forme that is placed in position for the actual printing.

The machine used by Gutenberg and other early printers was a simple screw press. The forme was placed on a plate known as the "bed," and dabbed with a large pad soaked in ink. A sheet of paper was then pressed firmly down upon it by the descent of the "platen," a second flat plate that was moved by the screw.

In later machines the forme was mounted on a carriage that ran on two rails. A framework hinged to the carriage held the paper in position and ink was applied by rollers instead of by a pad. When the type had been inked sufficiently the framework was folded over to bring the paper into contact with the face of the type. The printer then turned a handle to bring the forme into position and a pull on a long bar pressed the platen down to make the impression. The paper was covered by a pad or blanket to protect it from damage, and to ensure a steady even pressure.

Two men were necessary to operate the machine, and between the inking of the rollers and the removal of the sheet no fewer than nine distinct processes had to be performed.

The first great improvement was the introduction of the treadle platen press that may still occasionally be seen in small printing works. In this machine the bed on which the type is clamped is almost vertical. The platen is mounted on a pivot and is pressed against the face of the type by means of a treadle. In printing, the operator places a sheet of paper on the platen, where it is held in the correct position by adjustable fingers, and depresses the treadle. Releasing the pressure brings the platen back, when the printed sheet may be taken out and another inserted. While the change is being made, the mechanism causes inking rollers to run swiftly across the face of the forme.

When steam power became available it was easily applied to the platen press, and many machines of this kind are in use for such work as printing the beautifully coloured covers of the "*Meccano Magazine*."

The kind of machine that is now mainly used for general printing is modelled on the cylinder machine invented by Friedrich König in 1814. It derives its name from the heavy revolving iron cylinder that is used instead of a flat platen. The forme is placed on a horizontal bed that moves backward and forward underneath the cylinder. A sheet of paper fed into the machine is caught by grippers on the cylinder and carried forward between the latter and the moving forme. After printing the grippers release their hold of the paper and an automatic carrier removes it.

The cylinder machine is capable of great speed and its introduction led to efforts to increase the rate at which type could be set up. Suggestions and devices of several kinds were tried, such as rearranging the compartments of type cases and introducing improved methods by which the compositor could pick up the type. Although these schemes were carefully thought out, the increase of speed that resulted was very slight. There was always the trouble of returning the type to its correct boxes after printing, and this required about one-third of the time that was taken up by the actual setting.

Attempts were then made to replace the composing stick altogether, the first machine for this purpose being patented in 1822. In most of the early machines inventors arranged columns of types in convenient positions, and by mechanical means brought the desired characters together in correct order.

Some of these machines were successful, although not entirely perfect, one of the chief difficulties being the proper spacing of the words so as to secure even lines. It was also difficult and expensive to keep the machines supplied with type correctly arranged ready for composition. Greater success was at length attained by dispensing with the use of type and using instead a brass matrix or mould from which castings could be made.

The Linotype, introduced in 1886, was the first machine of this class. In appearance it resembles an overgrown typewriter. Pressure on the keys releases the matrices from their containers and assembles them line by line, and the difficulty of spacing the words is overcome by means of the use of wedges. From the matrices lines of type called "slugs" are then cast.

New type is cast each time any composition is done, and is melted down when printing from it has been completed. This is a great advantage, for it ensures that good type is used for every printing. The mechanical composition of type by this means took the place of straight-forward composition and revolutionised the printing industry.

The Linotype is invaluable in newspaper production, but is not suitable for all printing work as it casts type only in lines of a certain length. Another important point is that the finest printing is obtained by the use of single types. What is required, therefore, is a machine similar to the Linotype, but which casts single characters instead of whole lines. The wonderful Monotype has supplied this demand, and it is this machine that is used for setting the type for the "*Meccano Magazine*." Next month we shall see how the compositor uses it for this purpose, and then trace the progress of the "*M.M.*" through the press.



THE STORY OF OUR DAILY BREAD

BY
W. COLES FINCH

V.—FROM HARVEST FIELD TO FLOUR MILL

LAST month we described the successful efforts that have been made to breed types of wheat that would grow quicker without any loss in quality. In addition to this a great deal of attention has been given to the problem of producing wheat that would be resistant to disease.

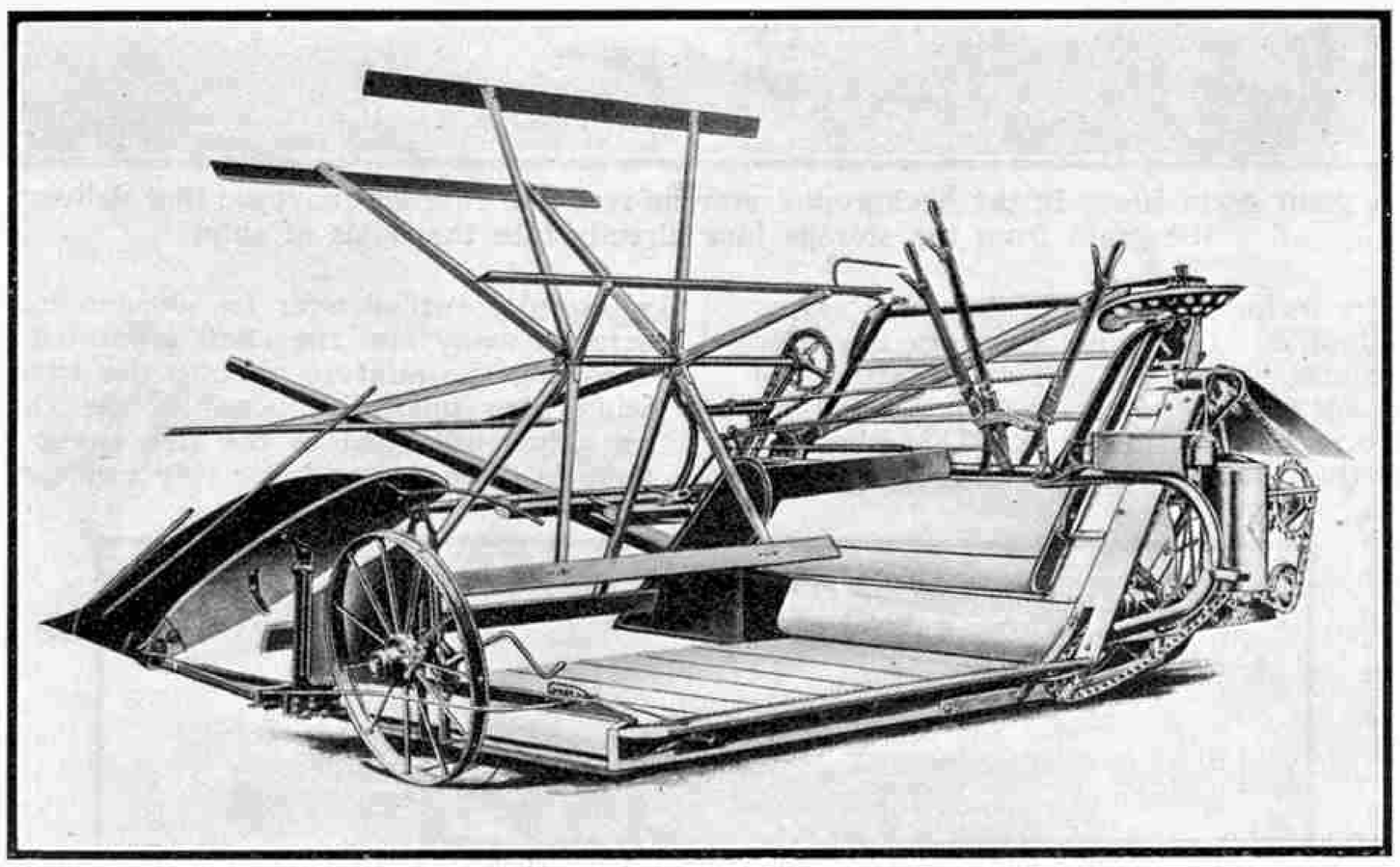
Two diseases of the wheat plant that cause great loss are smut and rust. Both are due to the growth of fungi. Grain from wheat infected with the fungus causing smut is brittle and is covered with dark-brown spores that give it the appearance of having been burned. Another fungus is responsible for a somewhat similar disease in which the spores have a characteristically fishy odour. Winter wheat is not so readily attacked by these diseases as spring wheat and the disease can be controlled by soaking the seed grain in dilute formalin, or in a solution of copper sulphate or blue vitrol containing 5 lbs. in 50 gallons of water.

The occurrence of rust is a far more serious matter. The fungus causing it lives in the leaves of the plant and when the spores burst through the epidermis they form red patches, the appearance of which has led to the use of the descriptive name. It has been estimated that this fungus is responsible for the loss of one-third of the world's wheat crop. Unfortunately no efficient method of disinfecting the seed is known, and the disease continues to be a very serious menace, especially in North and South America.

The rust that occurs in Great Britain produces yellow patches on the leaves and stems of the plant, and is not so prevalent as is the American variety. This is possibly due to the higher state of cultivation of the land and the removal of weeds that harbour the fungus. Its presence in wheat has long been associated in the minds of English farmers with the proximity of barberry. This is a thorny shrub with evil-smelling flowers that produce scarlet fruits in autumn, and except in some districts in South Wales it has been practically suppressed. The idea that there is some connection between the occurrence of barberry and the appearance of rust in wheat has been proved correct, for a fungus that attacks the shrub in spring has been found to be a stage in the life history of rust. This fungus passes summer and winter on wheat or some other cereal, and transfers to the barberry in spring. It does not appear in the grain when harvested.

The ravages of rust no doubt will be overcome in time. Possibly a careful study of the life habits of the fungus will end in the discovery of a method of destroying it, but at present the solution of the problem appears more likely to be found in the production of a variety of wheat that is immune. As a matter of fact several varieties for which rust-resisting qualities are claimed have already been produced and are undergoing tests.

The actual growing and harvesting of the corn next claims our attention. In this connection nothing is more remarkable than the survival until comparatively recent times of laborious methods that had been in use for centuries. A hundred years ago, for instance, corn was still being cut by the sickle or the scythe. Many would-be inventors were trying to construct machines to do the work more expeditiously, but they were laughed at as dreamers and reminded that nothing could take the place of honest toil. Their efforts met with ultimate success, however, and to-day machines are available for performing practically all the operations of preparing the land, sowing the seed and reaping.



Courtesy [*International Harvester Co. Ltd.*

Rear view of a McCormick binder. The knife is in front of the lower moving platform on which the reel lays the corn when cut. The binding mechanism is on the far side of the machine

Steel ploughs of shape and form calculated to give the best results; drills that distribute the seed uniformly and place it at the required depth in the soil; and machines that cut the ripe corn and bind it into sheaves ready for drying have made it possible to cultivate enormous stretches of land with comparatively little labour.

The most fascinating piece of modern agricultural machinery is undoubtedly the reaper. This we owe principally to Cyrus McCormick, an American farmer whose father had been one of the dreamers suspected of trying to replace honest toil. He had spent years in unsuccessful endeavours to make a reaping machine, but his dreams had come nearer reality than those of most of his rivals. The younger McCormick continued his father's work, and finally in 1832 produced a reaper that cut six acres of oats in one afternoon, a task that would have required the labour of six men armed with scythes.

Complete success did not come until ten years later, however. By that time the fertile plains of the Middle West of America had come under cultivation and manual labour was quite unable to cope with the task of gathering the increasingly large quantities of wheat that were grown. So far had the harvest outstripped the harvesters that cattle were turned into the wheat fields every autumn to eat the corn that the farmers were unable to cut. The introduction of machinery to increase the rate at which corn could be cut was thus an urgent necessity. Cyrus McCormick

foresaw this and established himself at Chicago, then a mere collection of rude huts in the centre of the new wheat lands. There he began to manufacture his reaper and it quickly won the approval of the farming community.

In Great Britain a reaper that resembled McCormick's had independently been invented by the Rev. Patrick Bell, a Scottish minister, but it did not attract much attention. The reason for this was said to be that the early examples were badly constructed, but possibly a truer explanation is that the need for it had not arisen, for when Bell's machine first appeared agricultural labour in Great Britain was cheap and plentiful.

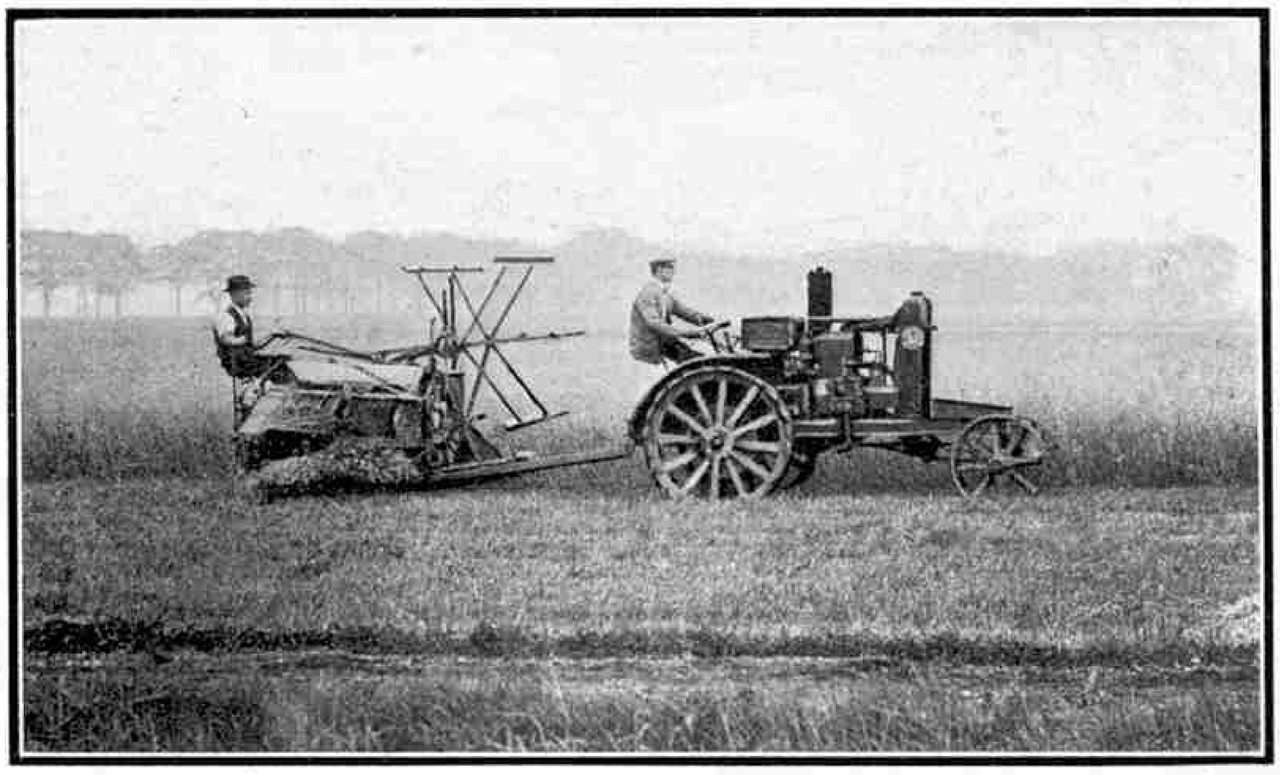
McCormick's reaper cut the corn by means of a long knife, the cutting edge of which was serrated to shear through the corn stalks as it was moved rapidly from side to side by means of a crank. Since its introduction many inventors have added to the value of the machine and their joint efforts have produced the remarkable reaper and binder almost universally in use to-day.

A modern machine may be drawn by horses or by a tractor. As it is pulled along, the rotation of the heavy main wheel drives the reciprocating knife that cuts across the swathe of corn in front of it. In falling, the corn is gently struck by one of the horizontal blades of the large rotating reel that is the most conspicuous feature of the machine, and laid on a moving canvas platform behind the knife. This platform is really a wide endless belt that takes the corn across the machine and directs it between two similar belts in front of the driver. These are set on an incline and they finally deliver the corn to the binding deck. There it collects until sufficient for a sheaf has been assembled, when a mechanical device rivalling human fingers in dexterity ties a knot in twine that is carried round the sheaf. The twine is then cut and the sheaf pushed off the machine.

It is now possible to attach a stooking device to the reaper. This receives the sheaves as they are bound and ejected, and sets them up in the familiar manner adopted to enable them to dry. The saving of time and labour made possible by the use of such a machine is remarkable. Two binders and stookers drawn by a small tractor can cut and set up from 30 to 60 acres of corn daily, three men only being required to operate the whole outfit. When this is compared with the one acre per day that a farm labourer of 1828 could cut with a scythe, the great advances in agricultural practice that the last 100 years have brought about may be realised. The task of feeding the enormously increased populations of wheat-eating countries would have been quite impossible had it not been for the work of Cyrus McCormick and his successors.



A giant grain silo. In the background may be seen the covered conveyor that delivers the grain from the storage bins directly into the holds of ships



An Albion binder drawn by a tractor. Reproduced by courtesy of the makers, Messrs. Harrison, McGregor & Co. Ltd., of Leigh (Lancs.)

When the corn has been cut and the binders have tied it up into sheaves, only a very small proportion of the work necessary for the production of our daily bread has been performed. The grain must be extracted from the ears and transported thousands of miles from the prairies and open spaces of agricultural lands to the great flour mills situated in more populous regions.

In the very earliest days of corn growing the seed was no doubt separated from the ear by hand. Later it was beaten out with a stick. It was in this manner that small quantities of corn were threshed in biblical days, for we read in the Bible that Ruth beat out the barley that she had gleaned in the fields of Boaz (Ruth, chap. II, v. 17).

Quantities too great to be threshed with a stick were then handled on open spaces called threshing floors, on which the sheaves were spread and oxen were driven round and round to separate the grain by trampling. The animals were usually harnessed together and muzzling them was forbidden by the Law of Moses. "Thou shalt not muzzle the ox when he treadeth out the corn" (Deuteronomy, chap. XXV, v. 4).

The end of the trampling left a mixture of straw, chaff and grain. This was repeatedly turned over by wooden forks. The straw was then scraped away and the chaff separated from the heavy grain by throwing the mixture up into the wind. In order to make this winnowing operation possible, the threshing floor was always on a low hill open to the free sweep of air currents. Harvest time in Canaan was invariably rainless and there was no risk of loss from bad weather.

The ancient Israelites were excellent farmers and extracted good crops from the kindly soil of Canaan. When their harvests became so great that quicker threshing was needed they began to crush out the corn by a heavy board dragged over the sheaves by oxen. Nails and sharp stone chips were fixed beneath the board and the driver piled heavy stones on it, or even stood on it himself, in order to increase its effect. It is to this board that the prophet Isaiah referred when he spoke of "a new sharp threshing instrument having teeth" (Isaiah, chap. XLI, v. 15).

Later still, the threshing waggon was introduced into Palestine. This had several rollers mounted in a rectangular wooden frame. Each roller was armed with three or four sharpened iron discs that cut the straw and the chaff as the machine was drawn over the corn by oxen. The threshing waggon has survived to this day in Egypt.

In countries less favoured than Palestine the chief instrument was the flail. This was a development from the simple stick used by Ruth and it remained the chief instrument of the threshing floors of Northern Europe for centuries. The beating staff was usually of ash or some other compact wood that did not split

easily. It was about 30 ins. in length and was attached to a hand staff by a leather thong. The hand staff was made long enough to allow the labourer wielding it to stand upright while bringing the beating staff down upon the corn.

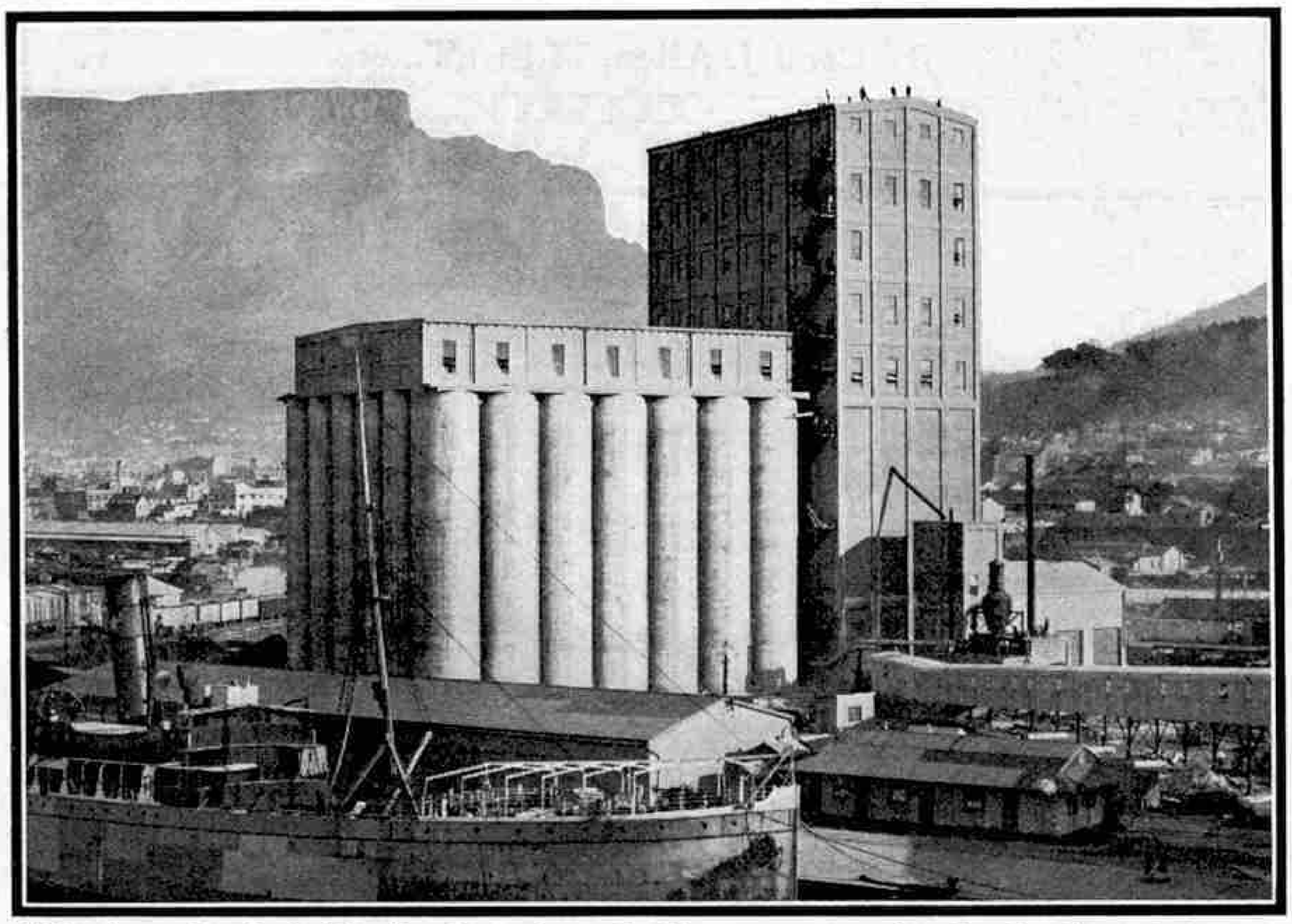
Rainless harvest weather is unfortunately very rare in northern countries and open threshing floors of eastern type were impossible. The work was therefore carried on in barns that were fitted with very large doors opposite each other to enable the winds to blow straight through. When beating was finished the straw was raked away and the chaff separated from the grain by the wind, if there was one, or by using a fan.

The unwieldy flail and wasteful trampling by oxen have now been replaced by a steam-driven contrivance that does the work far more quickly, and at the same time effects a preliminary cleaning of the grain. The modern threshing machine may be regarded as a power flail in which the beating out of the grain is done by grooved steel beaters on iron rods. These are fixed across several wheels placed at intervals along a common axis. The beaters are parallel to the axis, and as the drum-like structure revolves they strike against a concave plate of iron or steel that extends rather more than half way round the complete beater. The distance between the beaters and the plate may be regulated to suit the grain being threshed. A traction engine is used to drive the drum at 800 to 1,000 revolutions per minute. Thus if six beaters are used 4,800 to 6,000 strokes per minute are made.

The wheat is fed in between the beaters and the plate, where the grain is separated from the chaff and straw. On emerging from the beaters the straw is fed on to a series of rapidly oscillating boards that carry it along towards an opening through which it is discharged. The grain is shaken out of the straw and falls through openings between the shakers to riddles placed beneath. These have a slow reciprocating motion and keep back short pieces of straw, allowing grain, chaff and dust to pass through. A strong current of air from a fan blows out the light chaff and dust and the grain falls on to still another riddle of very fine mesh through which the remaining particles of dust fall.

By this time the grain has reached the bottom of the machine and it is now delivered into the cups of an elevator that take it to the top of the machine once more. There it passes over a screen in which the holes are too small for full-sized grain, but allow immature seed to fall through. The best grain is further riddled and winnowed before being delivered through a spout.

When dealing with grain on a large scale, as in Canada, threshing is either carried on in conjunction with reaping—an illustration of a combined harvesting machine appeared on page 801 of the October *"M.M."*—or the operation is carried out immediately the corn in the stooks has dried sufficiently. Stacking is unknown, while storage of the threshed grain in sacks has been abandoned in favour of bulk storage. After the threshing process the grain is taken direct to the enormous silos that are now so conspicuous in Canada and all countries where corn of any kind is grown. In them it is conveniently stored until required.



This view of a dockside silo shows how the bins are grouped. On the floor above are conveyors and chutes for distributing the grain

A grain silo is a collection of huge bins fitted with elevators and band conveyors to carry the grain into the bins and to deliver it to wagons, or, in the case of silos erected at ports, direct into barges or ships. It may be built of timber, steel or ferro-concrete, the latter material being very largely used nowadays. When steel is used as building material the bins are usually made circular in cross section, but the use of ferro-concrete enables hexagonal bins to be readily made. In one silo recently erected in England 18 storage bins in three rows of six were constructed, the only departure from hexagonal shape being made with the outside walls of the two outer rows. Thus the intervening space is utilised as fully as possible for storage. Strength is necessary in the construction of the bins, as the wheat acts like a fluid and exerts considerable pressure on the side walls. The accompanying illustration gives a general idea of a modern silo.

Incoming grain is weighed by automatic hopper scales and is then carried up to the floor above the storage bins by a bucket elevator. A band conveyor usually runs down the centre of the upper storey and a movable chute is provided to enable the grain to be delivered into any one of the storage chambers. The latter do not come down to ground level and thus the grain may be delivered by gravity feed through chutes to band conveyors that carry it to the waiting railway wagons or boat.

Silos are not always mere storage bins, for in many of them a preliminary screening is carried on to remove foreign matter, while the delivery chutes and conveyors are so arranged that the contents of the bins may be mixed together when necessary. All are well equipped with ventilators and fans to carry away dust.



Courtesy [*Canadian Government*

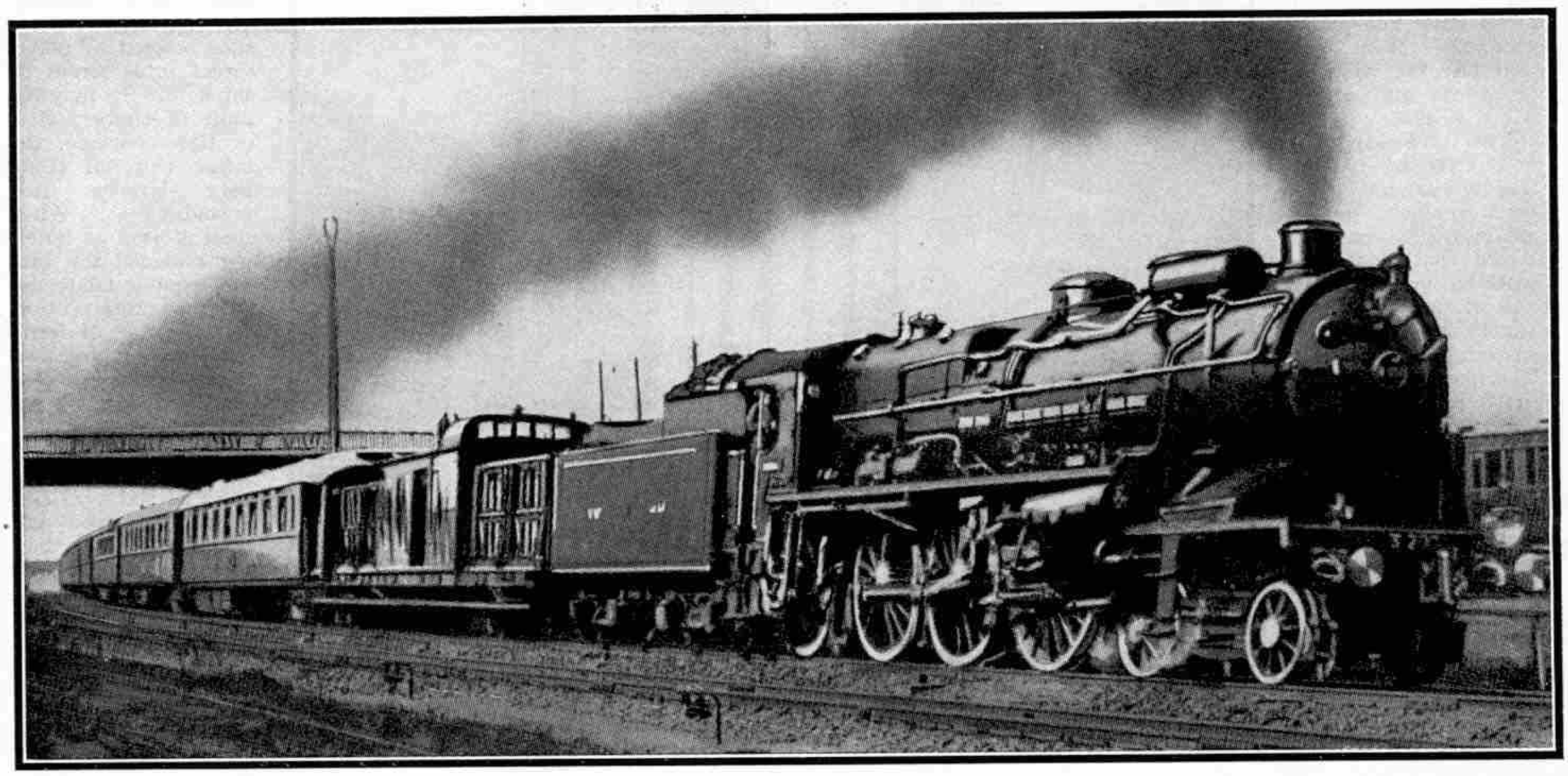
Reaping a fine crop on a prosperous Canadian farm

The use of silos has greatly reduced the cost and labour of transporting grain. They are built at convenient places in wheat-growing districts, and also at the great ports in order to make collection of the grain easy. From the storage bins of the huge dockside elevators the grain is shot into the holds of the vessels that carry it overseas. Most of it goes to Europe, where the world's great wheat-importing countries are situated. On arrival it is unloaded by wonderful pneumatic elevators and carried on band conveyors into warehouses or direct to the mills, where it undergoes the cleaning and milling necessary to make it into flour.

High Railway Speeds in France

Remarkable Timings on Long-Distance Runs

By Cecil J. Allen, M.Inst.T., etc.



The above illustration shows the "*Golden Arrow*" at full speed near Villiers-le-Bel, en route to Calais.

The locomotive is one of the famous 'Nord' Pacific Compounds. At the commencement of the return run, these powerful engines haul the 520-ton "*Golden Arrow*" up an incline of eight miles at 1 in 125 without difficulty.

EXPRESS train running in France to-day has many features of interest, and the most notable of these is the remarkable speeding-up that has taken place on all the French railways, including the State lines.

Until recently the fastest running in France occurred south of Bordeaux on the level line of the Midi Railway on to Bayonne and Biarritz. Here, with electric locomotives, the "*Sud Express*" was booked to run 91.7 miles from Bordeaux to Dax in 89 minutes, at an average speed of 61.8 m.p.h. —exactly equal to our fastest British run, that of the G.W.R. over the 77.3 miles from Swindon to Paddington in 75 minutes, at the same speed. In this summer's timetable the Midi had a second run over the same course in 91 minutes at 60.5 m.p.h. from start to stop, and still another in the opposite direction in 93 minutes.

This year, however, the Chemin de Fer du Nord has wrested from the Midi its title to premiership in the matter of speed, and the new booking of the 12.15 noon express from Paris to Berlin is, as far as St. Quentin, the fastest in the world for the distance covered. The 95.1 miles are scheduled to be covered in 92 minutes, start to stop, at an average speed of 62 m.p.h. There are long 1 in 200 gradients on this route, but with a load of 280 tons the old four-cylinder compound "Atlantics" of the Nord are amply capable of keeping time. More than once, indeed, they have gained five minutes by making the run in 87 minutes.

This is but one of the startling accelerations in the summer timetables of this enterprising railway. A luxurious new Pullman express from Paris to Ostend and the Belgian coast resorts daily covered the 156 miles from Paris to Lille in 155 minutes. The 10 a.m. boat express from Paris to Calais is booked to run the 140.9 miles from Paris to a stop at Etaples in 140 minutes, and there is another fast run to St. Quentin, in 95 minutes, making in all six long French runs that are scheduled at over 60 m.p.h. from start to stop.

At between 59 and 60 m.p.h. there is a whole string of further fast timings. Three times a day you may cover the 134 miles from Paris to Aulnoye in 135 minutes, and twice a day you can do the 119.4 miles to Arras in 121 minutes, while the non-stop expresses between Paris and Brussels and Paris and Dunkerque cover the same respective distances in the same times. Add to these a couple of runs over the 59.5 miles from Etaples to Amiens in 60 minutes, and you have to the credit of the Nord 11 daily journeys booked at between 59 and 60 m.p.h. Altogether there are 32 French start-to-stop journeys daily that are booked at between

58 and 60 m.p.h., of which all but five are to the credit of the Nord Company; and sixty booked at speeds of more than 56 m.p.h.

Some of the runs included in the foregoing figures, but not already mentioned specifically, are very difficult from the locomotive point of view. The famous "*Golden Arrow,*" for example, with a full load of 520 tons behind the tender of a 4–6–2 engine no heavier than the latest L.N.E.R. "Pacifics," has to mount an eight-mile incline at 1 in 125 immediately after starting, and then to maintain an average rate of exactly 60 m.p.h. all the way from the Outreau Junction at Boulogne to Paris (156½ miles), in order to maintain the schedule of 190 minutes for the 184.5 miles from Calais to Paris.

It is the P.L.M. Company, however, that specialises in loads, even though it may not favour the high speeds of its near neighbours. Now that the huge 4–8–2 ("Mountain") four-cylinder compounds have been introduced, loads up to 600 tons are commonly worked over the main line, and up the long 1 in 125 inclines between Les Laumes and Dijon the express trains, even with such loads as these, are scheduled at 43 m.p.h. On test, one of the new 4–8–2's has hauled a load of no less than 809 tons up this gradient at a sustained speed of 38 m.p.h. On the reintroduction of the *Cote d'Azur Rapide,* which is shortly to take place, it will have an average booked speed to Nice, on the Riviera, of 46 m.p.h., all stops included, and that with a restored load of 600 tons as compared with the pre-war figure of 280 tons—a jump that bears testimony to the increase in the popularity of long-distance railway travel in the interim.

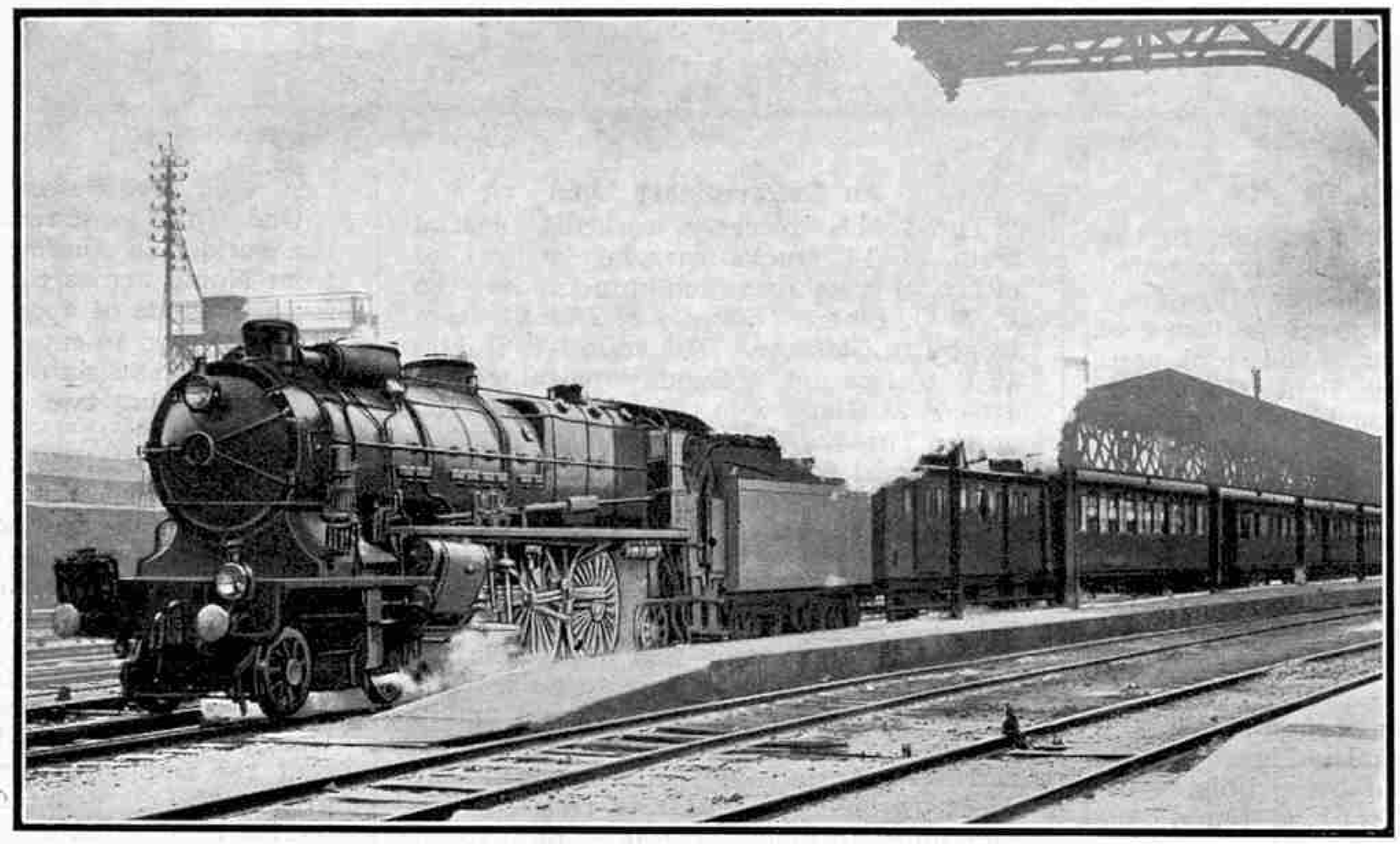
There has been speeding-up on other French railways also. The Est will now take you over both the 219 miles from Paris to Nancy and the 275 miles from Paris to Belfort, with only one intermediate stop in each case, at average speeds of 50.9 and 53.3 m.p.h. respectively. On the State lines, hitherto so leisurely in their transit, really wonderful accelerations have taken place, amounting to between 10 and 25 per cent. cuts in time in the case of practically all their express trains. To Havre, Deauville, Dieppe, and Rennes, distances of 141.7, 124.9, 133.4 and 232 miles respectively, the Etat now carries you at average speeds of between 50.8 and 51.5 m.p.h. over main lines with long stretches of 1 in 100 and other heavy gradients only slightly less steep, numerous severe service slacks and, in the case of the Rennes line, a limitation to a maximum speed of 62 m.p.h. for much of the distance.

The Nord takes the palm for long non-stop runs in France, the "*North Star*" Pullman express running the 192.5 miles between Paris and Brussels in both directions in 3½ hours, and the Dunkerque boat expresses, in connection with the Tilbury steamer, making runs of 189 miles without a stop, in both cases with slow running over curves and grades over portions of their routes. Four runs are also made over the 184.5 miles between Paris and Calais without stopping, the fastest of which are the 190-minute timings of the "*Golden Arrow*" Pullmans, to which reference has already been made.

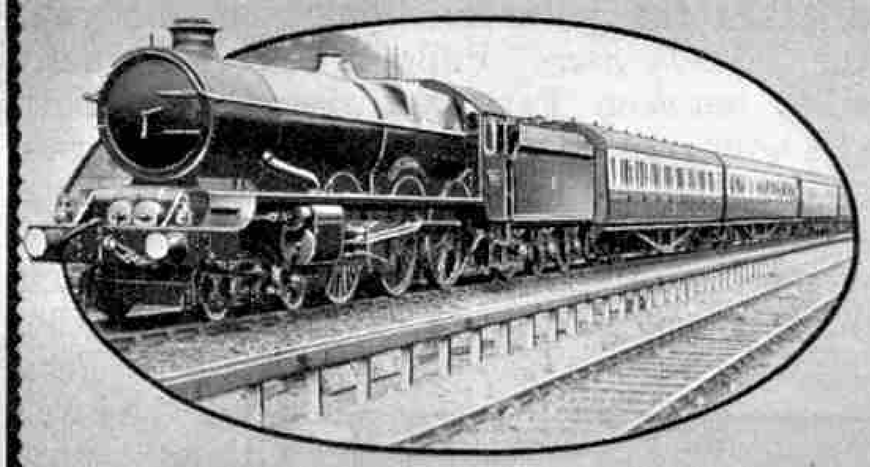
On all the foregoing journeys it is necessary for the engines to carry tenders with a very large water capacity, owing to the absence of any track-troughs from which the water supply can be replenished. Only the Etat Company has installed water-troughs; its longest run is over the 177.5 miles between Paris and Saumur, covered, over a most difficult road, in 211 minutes, at 50.5 m.p.h. The best long-distance effort of the Est is over the 172 miles from Troyes to Belfort, on the way to Switzerland, covered in 199 minutes, at 51.8 m.p.h.; but the same express does the 103.3 miles from Paris to Troyes in 106 minutes—a splendid average of 58.5 m.p.h., largely over rising grades, and the fastest journey in France on any other than the Nord and Midi Railways.

Probably the rapid extension of passenger-carrying services in the air has had much to do with these revolutionary improvements of train services that are taking place in France; road competition also may be responsible to some extent. Whatever may be the cause, it is quite certain that in the matter of railway speed France is gradually drawing ahead of Great Britain which, with but slight changes in train times, has remained stationary for so long.

The French Nord Company indeed may quite reasonably claim the title of the "fastest railway in the world," not even excepting the British Great Western Railway, although certainly the latter—Britain's most enterprising line by far in the matter of speed—runs the Nord very close. With the standard of perfection that has been reached in the design and construction of the latest British express passenger locomotives, and the excellence of the permanent way and the signalling arrangements, it is generally recognised that there are many official bookings on our Northern main lines that could be cut to a very considerable extent. Let us hope that the French challenge so thrown down may before long be taken up by the railways of Great Britain.



Another view of one of the 'Nord' Pacifics, No. 31225, starting out with the "*Golden Arrow*" on its run to the Northern coast



THE DOWN CHELTENHAM EXPRESS

RAILWAY NEWS

The Good Old Days !

Some interesting items relating to the construction of Box Tunnel are recorded in the "*Great Western Railway Magazine.*" The tunnel, passing through a range of hills that supplied most of the stone used in the construction of St. Paul's Cathedral, was commenced in 1836 by sinking eight shafts, each 28 ft. in diameter, and varying from 70 to 300 ft. in depth. The work was completed and the tunnel opened for traffic by June 30, 1841, but not before very considerable difficulties had been overcome. Several times during the course of construction the workings were flooded, work being stopped on one occasion for nine months.

Apart from the use of pumps, all the work was done by manual and horse labour, the excavated material being hoisted up the shafts by horses walking round and round and turning drums upon which ropes were wound. It is said that 300 horses were used in relays on the tunnel, with 40 boys to drive them. During most of the time work went on night and day and provided regular employment for about 1,200 men. This number increased to 4,000 during the last six months.

Thirty million bricks were used in the construction, and every week for 2½ years a ton of gunpowder and a ton of candles were used in blasting and lighting. It is stated that about 100 men were killed in different parts of the work during construction, in addition to a large number injured. Drunkenness and fighting prevailed to an alarming extent. Some 26 inspectors were employed in superintending the work and numbers of these were sent to the local villages to keep the peace on Sundays, as there was no county police force at that time. The workmen were housed mostly in the villages of Corsham and Box, and, being on duty night and day, one lot turned in as the other lot turned out and so the beds were never empty !

* * * *

£16,000 for Shunting Poles !

The L.N.E.R. point out, in a "*Use of Stores*" booklet recently issued, that 130,000 shunting poles are purchased every year at a cost of £16,000. A saving of £1,600 per annum would be effected if breakages could be reduced by 10 per cent. The company's annual coal bill amounts to over £4,000,000, and if every locomotive burned 1 lb. of coal less for every mile covered, £70,000 would be saved. The booklet also points out that 75,000,000 envelopes are used each year. As the cost of envelopes is approximately 4/-- per 1,000, this bill amounts to £14,000.

An Extraordinary Load

The L.M.S. recently worked a special train of 14 trucks carrying a load of electrical propulsion equipment for the P. & O. Liner, "*Viceroy of India,*" from Rugby to Glasgow. The train left Rugby at 6 o'clock on a Sunday morning and arrived at Glasgow in time to be unloaded on the Tuesday.

The total weight of the machinery was 152 tons and the trucks were loaded to the maximum height of 13 ft. above the rail level. The rotors for the two propeller motors were carried on two 40-ton well trucks. The diameter of the rotors was 11 ft. 5 in. so that it was impossible for two trains to pass on opposite rails. The train was stopped at each tunnel and a careful examination of the load was carried out, in addition to which the speed through tunnels was restricted to four miles an hour. The maximum speed of the train was 25 miles an hour, and special precautions had to be taken when starting, stopping, shunting and taking sharp curves.

THIS MONTH'S RAILWAY STORY

Passenger : "What's causing the stoppage, guard ? "

Guard (tired of answering similar questions) : "A new signalman in the box up there has got red hair, and we can't get the engine to pass him."

According to a report recently issued by the L.N.E.R., the "*Shire*" class locomotives are doing good work over the main lines between Edinburgh and Aberdeen, Perth and Berwick and Carlisle. It will be remembered that these 4–4–0 type passenger engines were introduced into the Scottish Area last March.

* * * *

Royal Albert Bridge

The Royal Albert Bridge joining Devon and Cornwall, and spanning the River Tamar at Saltash, Devon, which has remained practically unaltered since it was opened in 1859, has recently had the land spans reconstructed. The design of the bridge and its situation made it impossible for the usual methods adopted in reconstruction to be employed, and gave the G.W.R. Engineering Department a most interesting problem to solve. A special erection wagon was constructed for the conveyance to and from the site of the new and old girders. The wagon measures 95 ft. in length, 90¾ in. in depth, 4 ft. 3¼ in. in width, weighs 18½ tons, and is capable of carrying over 60 tons of girders at a time.

Dog-Power Railway

One of the most remarkable railways in the world is in Alaska, running northward from Nome across the Seward Peninsula for a distance of approximately 80 miles. Dogs are used to supply the motive power of the cars, and six dogs are quite capable of transporting two men from 40 to 50 miles in one day.

The track itself is of the usual narrow gauge type, and was constructed between 1900 and 1906 to facilitate travel and transport between Nome and the gold mines up in the north of the Peninsula. The service was worked by steam locomotives for some time, but eventually the mines were worked out, the railway fell into disuse, and the locomotives and cars were left to rust in sidings. It was then that the track began to be used by dog drivers who constructed cars suitable to be hauled by dog teams, with flanged wheels to travel along the permanent way. Such use was made of this novel method of transport that the line was purchased by the territorial government, who are now repairing the line especially for the use of dog teams.

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French Railway Centenary

The centenary of the first train to run on rails in France was recently celebrated. The first train ran on 8th October 1828 from the colliery centre of St. Etienne to Andrezieux and was made up of six wooden trucks, running on wooden rails. Although public interest in the event was very great and the driver was treated as a hero, it was necessary to load the trucks with coal, as no passengers brave enough to face the journey could be found !

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The Northern Counties Committee of the L.M.S. Railway have recently reported their intention of shortening the rail journey between Belfast and Londonderry by the construction of a loop line at Greenisland. The new line will be three miles in length, and will save 2½ miles' journey. No details as to the probable cost of the undertaking are at present available, but it is stated that the project has been made possible by a grant from the Government of Northern Ireland.

* * * *

The following 'Claughton' class locomotives are now running on the L.M.S.R., rebuilt with large boilers and Caprotti valve gear :—Nos. 5927 Sir Francis Dent, 5496 Duke of Connaught, 6013 (Unnamed), and 6023 Sir Charles Cust.

* * * *

Work is now well advanced on the new railway which is to link the Persian Gulf with the Caspian Sea. The contract is expected to be completed within five years.

Exhibition of Giant Locomotives

An exhibition of newly-built locomotives was held recently at the Manchester works of Beyer Peacock & Co. Ltd., the proceeds being devoted to hospital funds. The most interesting exhibit was a giant "Garratt" completed for service on the hill sections of the Nitrate Railway of Chile. This monster weighs 189 tons, and is claimed to be the largest railway locomotive ever constructed in Great Britain. Among its up-to-date fittings are a Worthington boiler feed pump, four Ross "pop" safety valves, electric lighting of gauges and footplate controls, and oil fuel installation. The locomotive is designed to haul trains weighing over 400 tons up a grade of 1 in 25, and three of the type are to replace seven heavy tank locomotives of ordinary design.

A second "Garratt" on view was of smaller type, weighing 131 tons, and with the 4–8–2 : 2–8–4 wheel arrangement. This has been built for the Kenya and Uganda Rly., which is of narrow gauge. A turbo-generator for the powerful electric head-lamps is mounted on the framing, and the engine is equipped with automatic couplers.

In vivid contrast to the temporary grey colour of the "Garratts" was a new 4–6–0 express engine for the L.N.E.R., No. 8580, of the familiar Great Eastern pattern, but fitted with Lentz patent poppet valves. There is no brass band round the chimney, but the bright splasher and cab heading and the standard express green of the company make this engine unusually attractive.

Other exhibits were the immense Ljungström turbine engine that has successfully worked express trains on the Midland section of the L.M.S., and a boiler to be fitted to a new "Garratt" of large dimensions. There were also on view a 0–4–2 crane tank and a tiny 0–4–0 with upright boiler used by the firm for shunting work, and various steam and motor wagons belonging to their road fleet.

The splendid workmanship shown by all the exhibits was greatly admired by a large crowd including, of course, many Meccano boys who thronged the footplates and climbed about the frames. R.S.M.

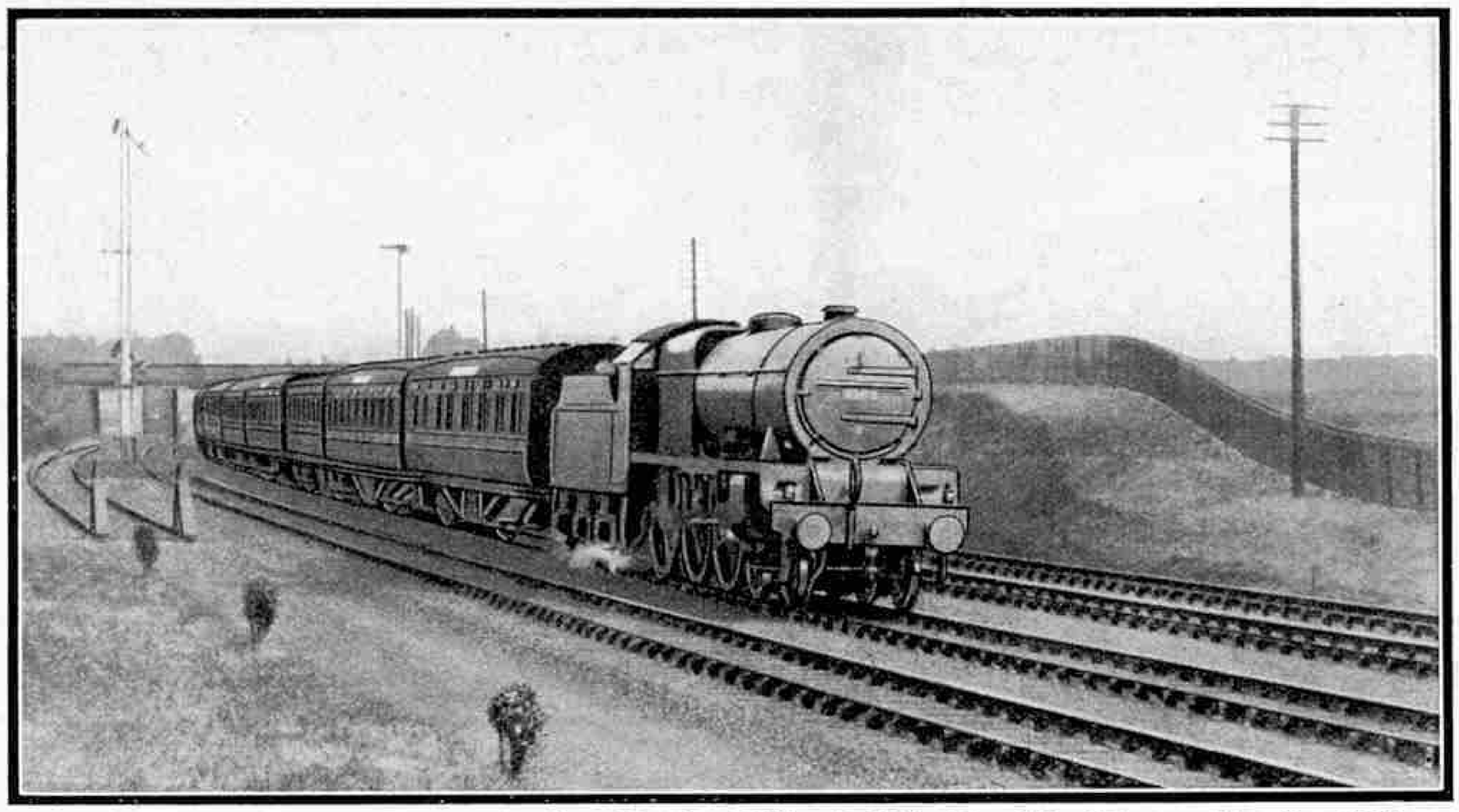
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Historic Railway Closed

The second oldest passenger railway in the world, the West Bridge line, between Leicester and Swannington, on the L.M.S. was recently closed to passenger traffic.

The line was constructed by Stephenson and opened in 1832 for steam trains. On the very first run the tall chimney of the engine collapsed and the passengers in the open carriages were "smoked out!" An interesting feature of the branch was the Glenfield Tunnel, said to be the earliest railway tunnel in the world. It was so narrow that in later days all compartment windows had to be barred to prevent injury to passengers. From Saturday night to Monday morning, right up to the closing of the line, the tunnel was closed by a white padlocked gate at each end.

At first the signalling of trains through the tunnel was carried out by means of an hour-glass. This was reversed when a train entered, and no other train was allowed to proceed until the sand had fallen through! The line also had the distinction of evolving the earliest engine whistle. After several accidents at crossings, George Stephenson, then one of the directors, devised what was virtually a steam trumpet, and the engines of the line were so fitted by a Leicester musical instrument maker. R.S.M.



The 'Up' Merseyside Express leaving Mossley Hill. L.M.S. Royal Scot locomotive No. 6102 *"Black Watch"*

* * * *

Educational Excursions

Educational excursions are a comparatively new feature in railway practice, but during the past summer they have demonstrated that they have found a definite niche in public favour. Well-patronised trips have been run by each of the railways, notably to big works located on their systems. The G.W.R. trips to Lever Bros.' works at Port Sunlight, Fry's at Bristol and the locomotive shops at Swindon have been particularly popular, but it is probable that all records were broken by a recent S.R. excursion to Southampton Docks.

From Waterloo alone three trains were run, while other sections were brought in from Exeter, Portsmouth, Southsea and Bournemouth. It is estimated that over 10,000 people passed over the U.S. liner *"Leviathan,"* which was lying in the Ocean Dock at the time. Other liners that were included within the scope of the tour were the Cunarder *"Mauretania"* and the Royal Mail liner *"Asturia."*

* * * *

A Mile-Long Train

What was probably the world's longest train recently ran between Regina, Saskatchewan, and Winnipeg, on the Canadian Pacific Railway. The train consisted of 135 wagons of grain and was over a mile in length.

News from Manchester

L.M.S. "Claughton" class 5979, *"Frobisher,"* has been overhauled at Crewe and, while retaining its original boiler, is now fitted with low chimney, dome, and horizontal whistle, while "Pop" safety valves are sunk in the original Ramsbottom valve seating. A tender of Great Central type from the ex-R.O.D. stock is attached and the general appearance of the engine as rebuilt has evoked very favourable comment.

The locomotive that ran over the buffer stops at Euston in August while hauling the "Mancunian" Express was the rebuilt Claughton *"Breadalbane"* from Longsight (Manchester) shed.

Electrification of the Manchester, South Junction, and Altrincham line is shortly to be proceeded with on the overhead principle. Trains on this busy suburban section are at present worked by L.N.E.R. 2–4–2 tanks and L.M.S. (North Stafford) 0–6–0 tanks, with occasional working by various 0–6–0 tender classes.

Following their delivery from the Gorton Works of Beyer Peacock Ltd., several of the new L.N.E.R. 4–6–0 express engines were "run in" by working local trains. These engines are generally similar to the well-known "1500" class of the Great Eastern section, but are fitted with Lentz patent poppet valves and Ross safety valves. They also carry Great Eastern pattern chimneys, but without the brass band round the top.

Great Central 4–4–0's of the very handsome class that preceded the heavier "Director" type are being fitted with the standard built-up chimney and, in some instances, with very diminutive dome casings. Like many other main line passenger engines on the L.N.E.R. they are painted glossy black.

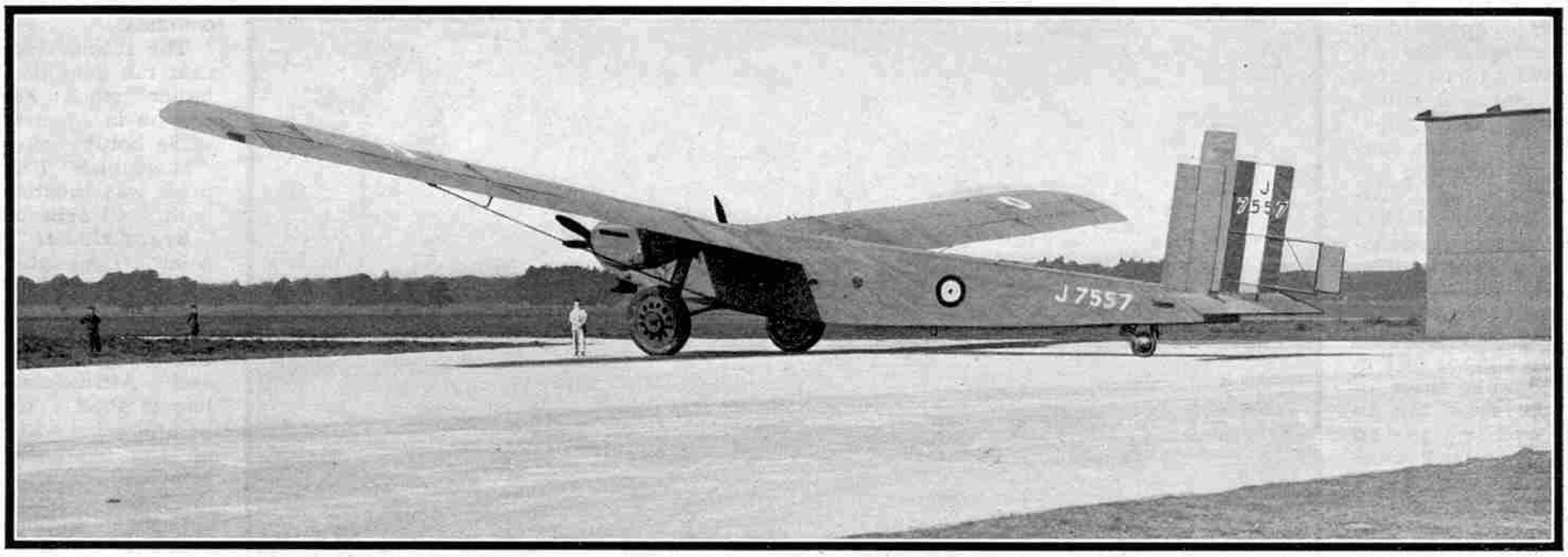
The heavy grades of the L.N.E.R. lines from London Road to Derbyshire call for powerful locomotives on most trains, and 0–6–0's of the "Pom-pom" class do good work. It is possible to see three varieties of chimneys on this class, namely, the original tapered pattern, the narrow straight design that follows it, and the less artistic standard pattern of the L.N.E.R. R.S.M.

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Daily for 20 years the Cornish Riviera Express has left Paddington Station on her 225¾-mile non-stop run to Plymouth. The Great Western Railway have now announced that in future the express will stop at Exeter. instead of slipping carriages as formerly. This alteration will lengthen the four-hours journey by seven minutes, but is expected only to remain in force during the winter months.

World's Largest All-Metal Monoplane

A Wing Span of 150 ft.



There is a growing tendency to-day toward the adoption of all-metal flying boats. The first machine of this type was the "Beardmore-Rohrbach" flying boat built in 1925 by William Beardmore & Co. Ltd., Glasgow, the constructors of the all-metal monoplane "*Inflexible*" described in this article and shown in the above photograph. The "*Inflexible*" has a wing span of 150 ft. and is the largest all-metal monoplane in the world

THE largest monoplane in the world is now in the possession of the Air Ministry and is an achievement of British design and construction throughout. This is the "*Inflexible*" all-metal monoplane built by William Beardmore & Co. Ltd. of Glasgow.

The machine is of stupendous size and has a larger span than that of any other land machine yet constructed, measuring 150 ft. from wing tip to wing tip. This span indeed is so great as to have caused very considerable difficulty in housing the machine. Even the enormous hangars at Croydon Aerodrome were scarcely large enough to admit it, and at Martlesham Heath it was only possible to get the machine under cover by moving it sideways. Two standard Royal Air Force fighters could comfortably nestle under each of the mighty wings of this monster!

Even the tail fin and rudder rises practically unsupported for more than twice the height of a man above the fuselage, which, with the tail wheel on the ground, is itself some 6 ft. above the ground. The stout rectangular fuselage in the cabin section is about 12 ft. in depth. Perhaps the most vivid impression of this super-magnification of the normal aeroplane was the spectacle, during its recent trials, of a man walking along the wing to examine the controls, as casually as a passenger walking up a ship's gangway.

The machine is constructed upon the general principles adopted by Dr. Rohrbach. Metal is used exclusively, including the skin of wing and fuselage, which is of duralumin. For certain highly-stressed fittings steel is employed, but apart from this the entire machine is built of duralumin.

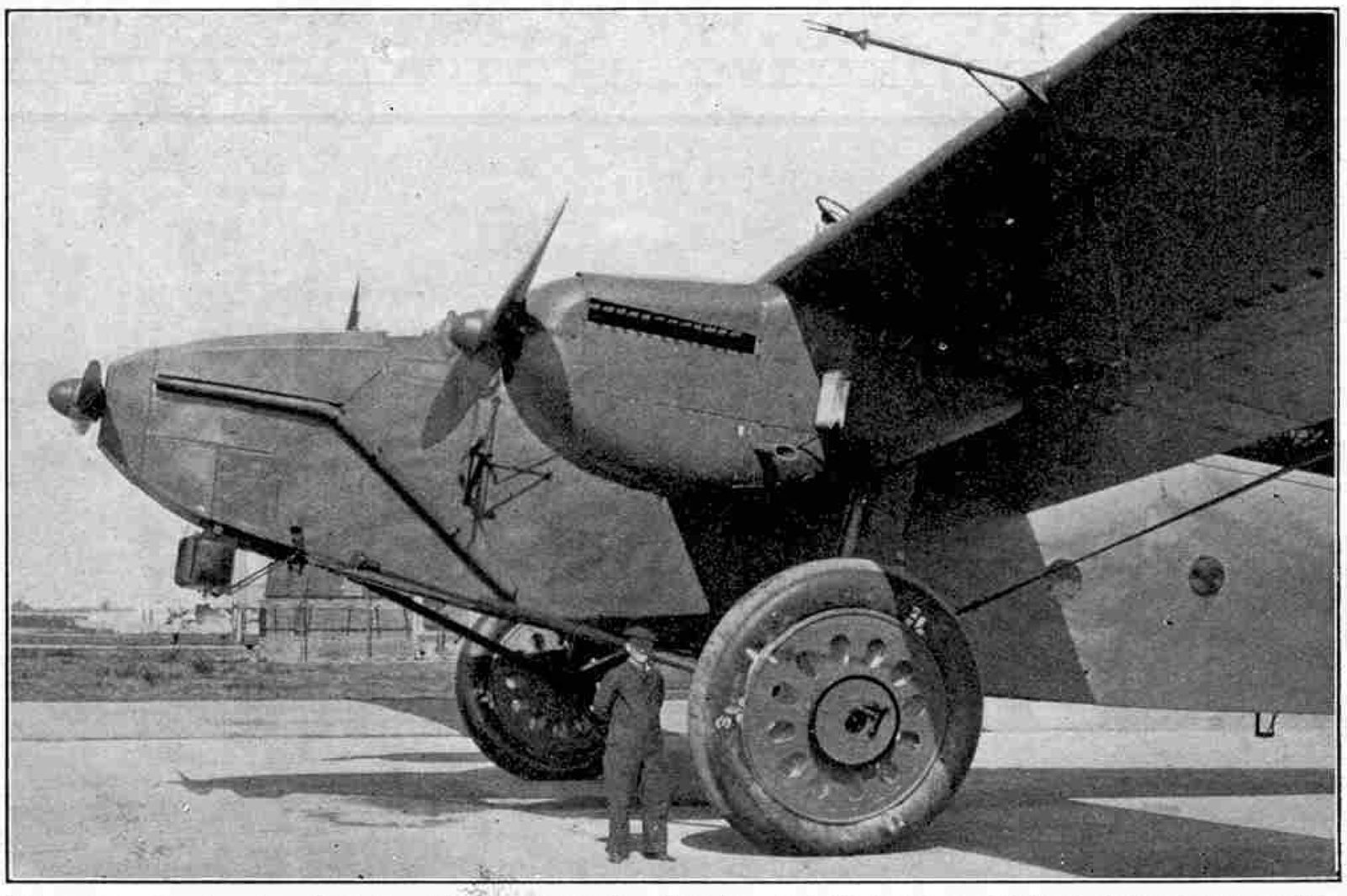
Three 650 h.p. Rolls-Royce Condor engines are fitted, one situated in the nose and the others one on each side of the fuselage. The total weight of the machine is nearly 20 tons. It is capable of holding at least 20 passengers, and even with this weight it should be able to carry fuel for a flight of many hours' duration.

The design of such an aeroplane called for tyres of an enormous size corresponding to 7 ft. 6 in. by 16 in. in English measurement. The dimensions of the wheels considerably exceeded those of any wheel of the kind ever constructed before, and no data existed upon which the design could be based. The task was made more difficult by the fact that the weight was not to exceed a certain figure, while in addition the wheels were required to withstand heavy torsional loads due to braking—a very unusual feature in aeroplane wheels. It was soon found that the normal type of wheel employing spokes was not likely to be satisfactory in this enormous size and an altogether new type of wheel was investigated. A high tensile steel wheel-base rim and a central steel shell were connected with stiff radial plates of duralumin with disc sides of the same alloy, and the whole structure was riveted rigidly together.

The production of the wheel was greatly impeded by the prolonged industrial dispute. It was only after considerable trouble and delay that small quantities of the necessary raw material were obtained, and much of this was quite unsatisfactory and had to be rejected. The wheel was completed at last, however, and it then passed the maximum test load of over 28 tons by a large margin. As a matter of fact the test was only stopped because the limit of the testing machine had been reached. The wheel complete with tyre was then placed on a metal platform and a spindle was passed through the hub. Subsequently

the wheel was held at different angles to the line of loading, representing the conditions obtaining under the stresses and strains of heavy loading and bad landing. Such was the success of this effort that the breaking load for the wheels was over 48 tons, and a special testing machine had to be constructed for them.

The tests at Martlesham Heath were carried out without the slightest hitch. The machine lifted easily and climbed with the utmost steadiness. Although nothing in the nature of strenuous manœuvres was attempted, the behaviour of the machine was clearly shown to be excellent and apparently it was very easy to handle and control. The landing was particularly noteworthy for its gentleness and for the demonstration of the effectiveness of the brakes, resulting in pulling up the machine in somewhere about 300 yards from the point of first contact. The pilot, Squadron-Leader J. Noakes, appeared to be well satisfied with the behaviour of the machine.



This photograph, showing the "nose" of the "*Inflexible*," gives a striking impression of the gigantic size of the machine in general and in particular of the wheels

It is interesting to note that the idea of using steel for the construction of an aeroplane is by no means new, for it was adopted at the end of the last century by Sir Hiram Maxim. It is easy for us to smile at Maxim's huge and clumsy machine, which weighed nearly four tons, yet in many respects the inventor was working on right lines, and even with an utterly inadequate steam power plant he achieved results from which many valuable lessons were learned. He employed metal very largely in the construction of his machine, making use in particular of steel tubes of large diameter together with steel strips. In short, Maxim's aeroplane was constructed up to a certain point on sound engineering principles and it actually succeeded in lifting itself into the air, carrying passengers, engine, boiler, water and fuel.

Two Great Motor Liners—

(*Continued from page* 916)

actual service both vessels have maintained the high standard of efficiency of which they gave evidence at their respective trials.

The "*Asturias*" and the "*Alcantara*" have already proved an outstanding success and amply demonstrate that the large motor liner has come to stay. The steamship has displaced the sailing vessel, but whether the former will in turn be outstripped by the motor ship remains to be seen. A glance at shipping statistics certainly shows a remarkable increase in the number of motor ships within recent years. Of 24,444 vessels in service in 1914, only 297 were motor ships, but of a total of 29,029 vessels on the sea in 1926, motor-driven ships numbered 2,343! Since that time the percentage of new motor ships has increased steadily, and it is anticipated that 1928 will prove to have been a record year in this respect. This continued development augurs well for the future of the motor ship.

"Coaling Ships by Machinery"—

(*Continued from page* 875)

the coal into a second hopper called the "receiver," from which it slides down a telescopic chute leading directly into the steamer's bunkers. This chute is attached to the receiver by means of a universal joint and can be lengthened or shortened as required. It is raised or lowered and moved to the right or the left by means of a small crane pivoted to the top of the receiver. The ladder, the hopper and the chute are totally enclosed so that the coal is conveyed from the elevator to the bunkers of the ship without being exposed to the air at any time during the transfer. There is thus no possibility of coal-dust polluting the atmosphere and dirtying the ship.

The coaling elevator just described was designed for a guaranteed output of 600 tons per hour, but during her trials she succeeded in coaling a vessel at the record rate of 1,052 tons an hour.

When the elevator is not in operation or is being towed from one place to another the receiving and the delivery arms are hoisted up so as not to overhang the pontoon in any direction. This enables the machine to be towed through a crowded harbour without risk of her unwieldy superstructure becoming a source of danger to other vessels.

The swinging ladder has to operate occasionally far outside the pontoon, and it is necessary to make provision against excessive list and consequent interference with the accuracy of the weighing machine. For this purpose an arrangement is provided by which water is pumped automatically into tanks fitted into the pontoon at the side opposite the swinging ladder as soon as the list exceeds a certain limit. In this manner the equilibrium of the whole structure is always maintained.

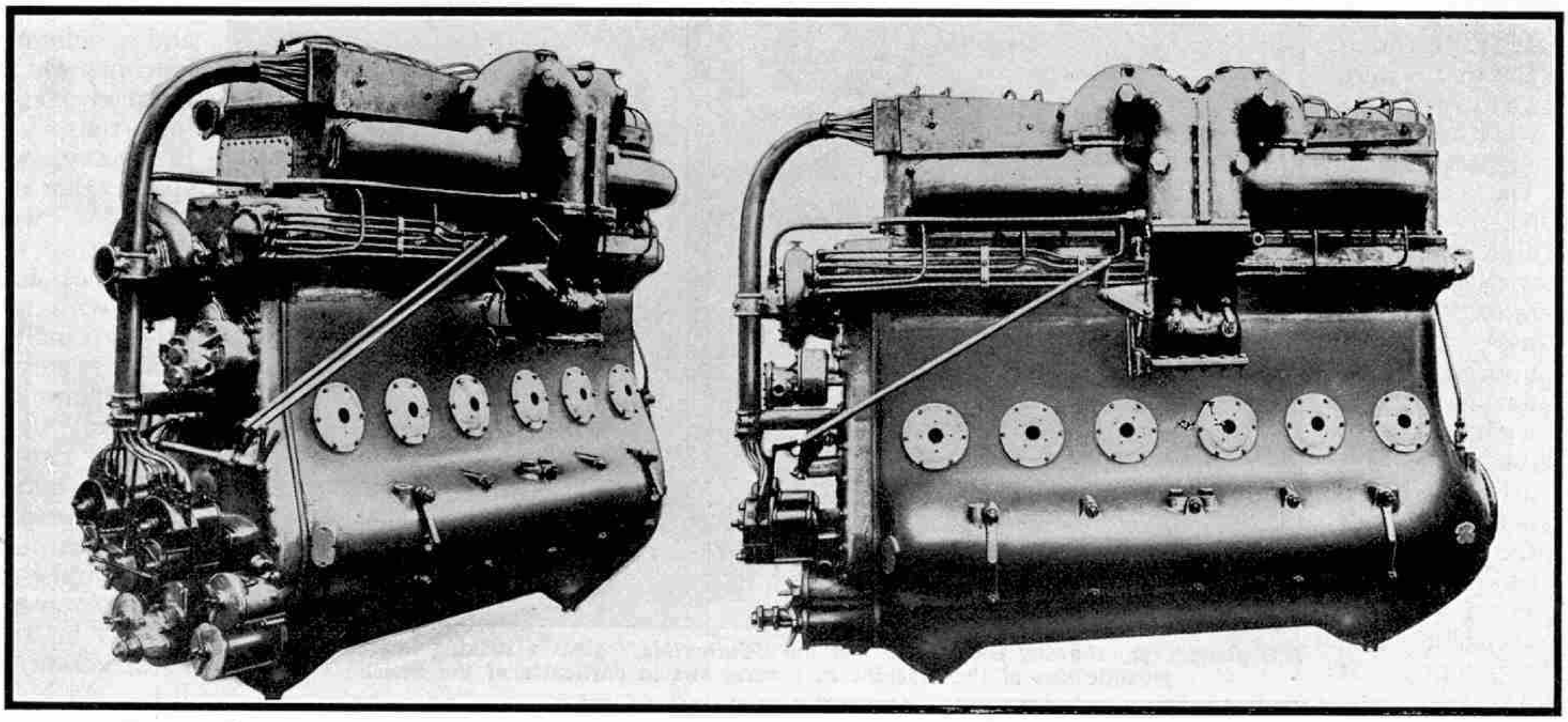
Owing to the conditions in which the elevator has to work there always exists a certain risk of collision and as a safety measure the pontoon is divided into a large number of separate watertight compartments.

The self-propelling coaling vessel of which the recently built "*Bujun Maru*" is a typical example, is another innovation of the Schiedam firm. This vessel has a smaller output than the massive elevator just described but it has the advantages of being able to dispense with attendant coal barges and of being capable of moving about under its own power. These vessels have a very spacious hold divided into compartments by transverse bulkheads. These compartments empty themselves one by one, the coal gravitating through sliding doors on to the buckets of a conveyor that runs in a tunnel above the ship's keel. This arrangement makes it possible to store different grades of coal and to mix them if required.

The chain of buckets is driven by either of the two compound engines installed for driving the twin-propelling screws. When the buckets of coal reach the bows of the vessel they are passed over a weighing machine and from that point onwards the coal is dealt with in the same manner as in the coaling elevators. Self-propelling coaling vessels of a capacity up to 1,100 tons and capable of discharging at the rate of 250 tons per hour are now in regular use and are giving excellent service.

Famous Aero Engines

IV.—The Beardmore "Cyclone" and "Typhoon"



The illustration above shows two views of the Beardmore "Cyclone" aero engine. That on the left shows the rear end, that on the right the induction side.

The normal power of this engine is about 900 h.p. at the very low speed of 1,350 r.p.m. The petrol consumption is remarkably low, being 0.48 lb. per h.p. per hour.

IN previous articles in this series we have described famous aero engines of both radial and the Vee type; this month we are to consider two interesting engines of quite distinct design. These are the 900 h.p. "Cyclone" and "Typhoon" engines, designed and developed by William Beardmore & Co. Ltd.

The "Cyclone" (Mark II) is a six-cylinder "in-line" engine of $8\frac{5}{8}$ in. bore and 12 in. stroke. Among its outstanding features are the substantial reduction effected in the number of moving parts, as compared with engines of other types; the remarkably low fuel consumption, and the general simplicity of operation and maintenance.

The tall cylinders and deep crankcase of the "Cyclone" give it some resemblance to a semi-Diesel engine, but whereas the latter is run on crude oil, the aero engine does not depart from the conventional aero practice of consuming petrol evaporated by means of carburetters. The compression ratio is low, being only 5.25 to 1. Ignition is by two magnetos.

According to whether small or large carburetters are fitted, the "Cyclone" develops 850 h.p. or 950 h.p. This power output is developed at the very low speed of 1,350 r.p.m. The low speed of revolution has several advantages, among them that of enabling propellers of very high efficiency to be employed without the necessity of having recourse to any system of gearing. On the "Cyclone," consequently, the propeller is attached direct to the crankshaft.

The fuel consumption is low and indicates that the "Cyclone" should be very economical in operation, at any rate for flights of fairly long duration. The petrol consumption is .48 lb. per b.h.p. per hour and the oil consumption .01 lb. Taking round figures, the total consumption on full throttle running is $\frac{1}{2}$ lb. per horse-power per hour, or at the maximum power of 950 b.h.p. it is 475 lb. For 10 hours, however, the figure is only 6,900 lb., which undoubtedly is remarkably low for an engine developing 950 b.h.p.

The weight of this interesting power unit is only 2,150 lb. "dry"—that is not including the radiator, the fuel, or the cooling water. The weight-power ratio is 2.4 lb. per b.h.p.

The main outside dimensions are as follows:—length 80.3 in.; width 35 in.; height above centre line of crankshaft, 46 in.; depth below centre line of crankshaft, 15.125 in.

The "Typhoon" is an inverted edition of the "Cyclone"—that is to say, it is mounted so that the cylinders project downward from the crankcase. This engine develops between 800 and 900 h.p. at approximately 1,300 r.p.m. from six cylinders arranged in a straight line. An engine of this type can be installed into a fuselage nose considerably narrower than is required for a Vee or radial type of engine of similar power. There is the further gain that an inverted engine will permit of the nose projecting less above the airscrew axis than is the case with any engine of the "cylinder-on-top" type. The natural result of this is to allow of a top deck to the fuselage that is not only narrow but also has a good slope downward, thus simplifying the task of providing the best possible

view ahead and downward, for the pilot.

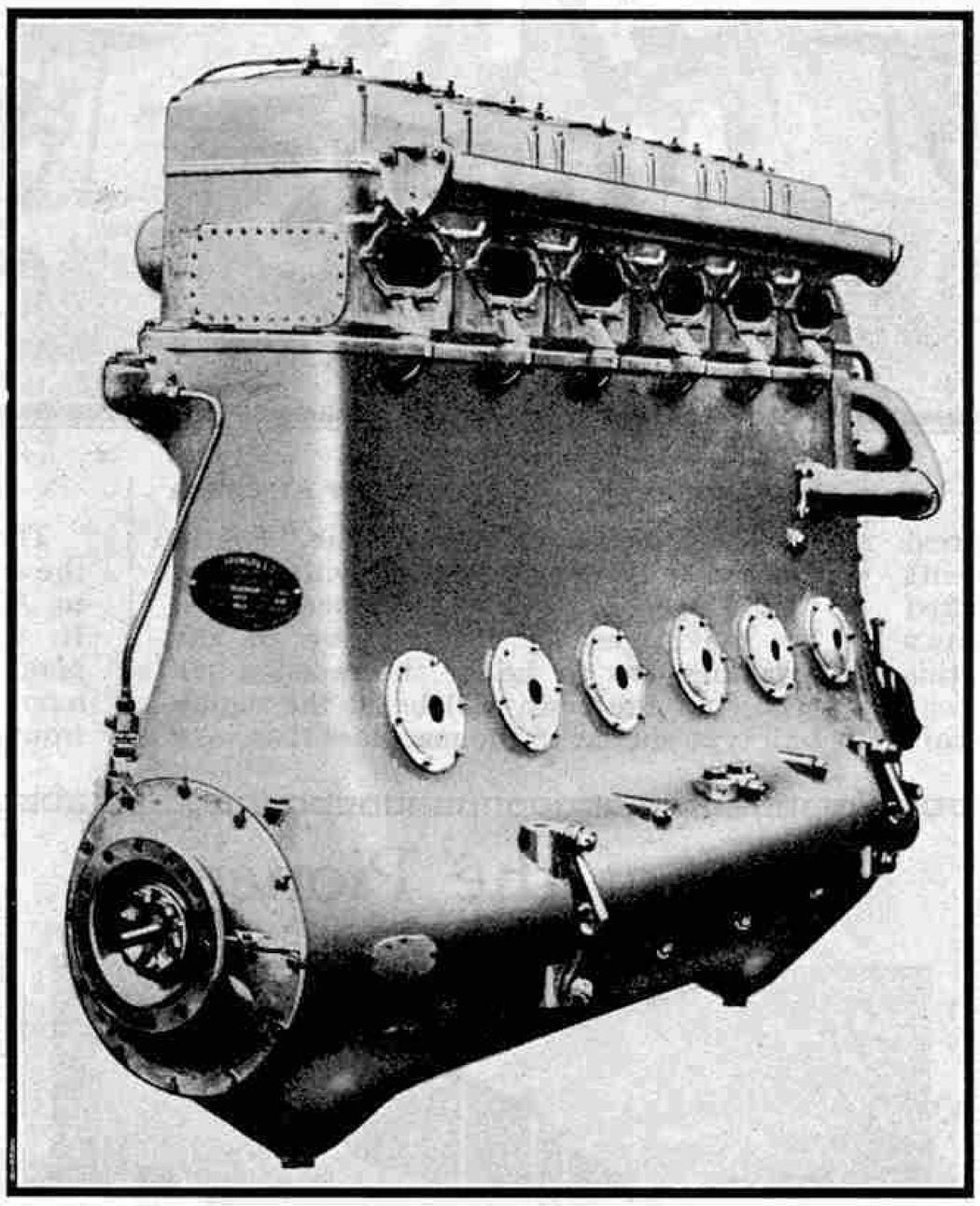
The mounting of the "Typhoon" is accomplished in a very simple manner. No engine-bearers are required, as the crankcase itself is of sufficient rigidity to allow these external aids to be dispensed with. All that is necessary to carry the engine is a set of four steel tubes on each side running to the fixings that are provided on the crankcase.

On account of the employment of a small number of large cylinders, the engine has a comparatively small number of working parts of adequate strength, which inevitably tends towards reliability and long life. A further feature is that large cylinders, generally speaking, give rather higher thermal efficiency than small ones.

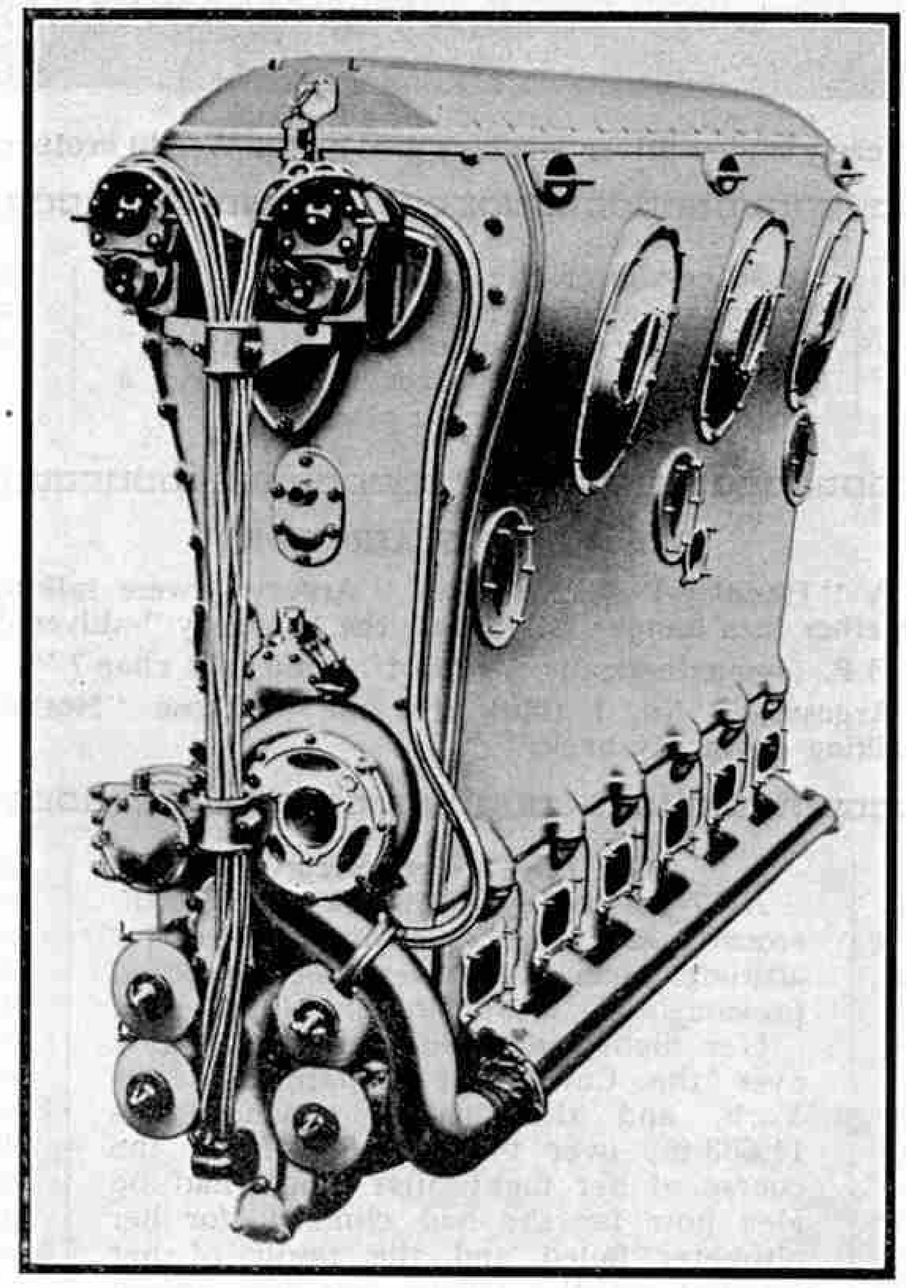
The fuel and oil consumption of the "Typhoon" is extremely low, being stated to total only .46 lb. per h.p. hour. This is appreciably lower than the average figure for a modern multi-cylindered machine and therefore for long-range aircraft the "Typhoon" should be very economical in running; the saving in fuel more than counterbalancing a slight increase in engine weight resulting from the use of a small number of cylinders.

The "Typhoon" made an excellent impression when, installed in an Avro "Aldershot" machine, it was publicly exhibited at A. V. Roe & Co.'s aerodrome at Hamble. This demonstration disposed of any fears that the individual "kick" from six cylinders, each developing some 150 h.p., would lead to violent torque reaction and serious vibration. As a matter of fact, in the "Aldershot" the "Typhoon" was quite remarkably smooth-running, and at all service speeds it ran dead steadily. The pilot, Mr. Bert Hinkler, expressed himself as extremely satisfied with the smoothness of running in the air.

The demonstration showed that the "Typhoon" starts up very readily under the influence of its gas-starter, ticks over at a remarkably low speed, and opens up without the slightest fault. It took the "Aldershot" off the ground with an unusually short run and, from Mr. Hinkler's manœuvres close to the ground, it was obvious that he had little doubt about the reliability of his engine.



The Beardmore "Cyclone" viewed from the propeller end. Note the clean finish of the crank case



The Beardmore "Typhoon" engine which is of the inverted type

It is an interesting fact that the "Aldershot" machine in which the "Typhoon" engine was demonstrated is the same machine as that in which the first Napier "Cub" was installed.

The idea of the inverted engine is by no means new, for this type was in use in aircraft of various kinds before the war. During recent years, however, comparatively nothing has been done to develop it, in spite of its undoubted advantages for aircraft. Quite apart from its convenience from an installation point of view, the inverted engine simplifies the arrangement of gravity feed, the carburetters being automatically situated lower for the same position of crankshaft.

William Beardmore & Co. Ltd. are constantly engaged upon the production of aero engines and have carried out some very valuable pioneer work. Unfortunately, owing to British Air Ministry requirements, the designs of many of these engines are more or less secret. It is interesting to learn, from information that has already been published by permission of the Air Ministry, that this firm have been responsible for the production of the first practical aero engine designed to use crude or heavy oil as fuel.

The airship R.101, now being constructed for the Air Ministry at the Royal Airship Works, Cardington, is to be fitted with five eight-cylinder "Tornado" engines using a light paraffin fuel that has the very valuable property of being much less inflammable than petrol. A novel feature of these engines is that they are designed to run at a constant speed of 1,000 r.p.m. and are fitted with variable-pitch propellers. This arrangement enables the engines to be run always at their most efficient speed and, in addition, makes it possible for the airship to be stopped quickly by a complete reversal of pitch. The weight of these engines is 4,600 lb. and they will have a rating of 650 b.h.p. The trial flight of the airship is awaited with interest.



Smoke Clouds to Hide Towns

The German Air Ministry have carried out recently a series of experiments with a new type of smoke cloud invented by Dr. Reddeman, who is Germany's leading gas expert. The object of this invention is the rather startling one of making a large city invisible within a few seconds to all aircraft in the vicinity!

During the tests a number of buildings in the town of Boblingen, near Stuttgart, were completely blotted out by a smoke cloud. Around the buildings were placed at intervals of about 70 yds. ten vessels each containing 24 gallons of a secret chemical substance and all electrically connected. At a given signal an electric switch was closed and immediately a cloud of dense fog, 300 ft. in height spread over an area of 500 sq. yds. in six seconds. It is obvious that smoke clouds of this nature would be of more use in the protection of a town from attacks of enemy aircraft than even the most formidable barrage of anti-aircraft guns.

The results of the experiments were so satisfactory that work has been started at Cuxhaven on the construction of a plant to store enough of the secret chemical substance to hide the seaport in the event of war. Cuxhaven is the outport of Hamburg and owing to its situation at the mouth of the River Elbe would be of great strategic importance in war-time.

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Revolutionary Aeroplane

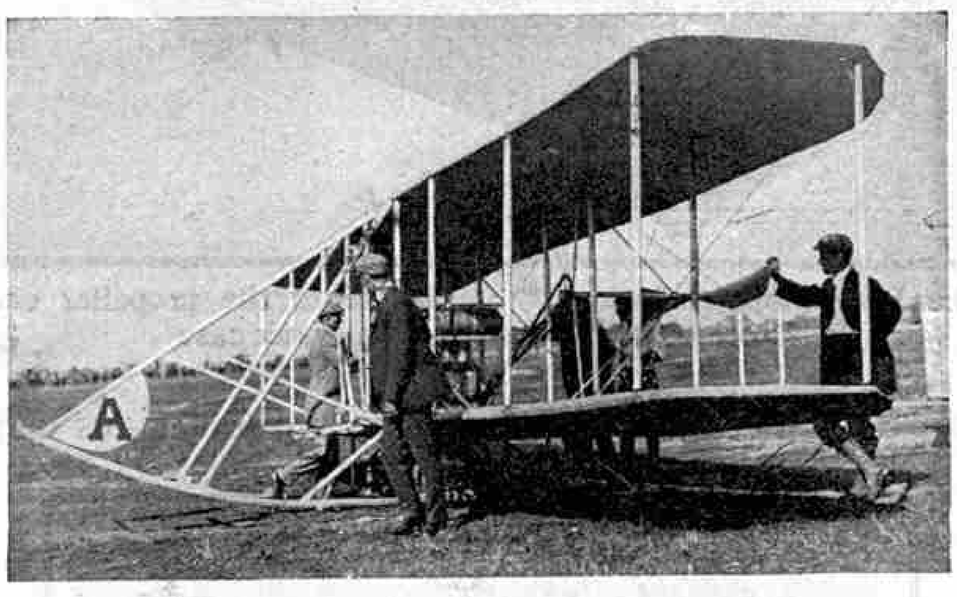
A new company with a capital of £20,000 has been formed in Wichita, Kansas, U.S.A., to exploit an entirely new type of aeroplane. The company make the remarkable claim that their machine can fly either backward or forward, cannot fall out of control, will land without the aid of a pilot and will fly 2,000 miles on 200 gallons of petrol!

Rotors form the motive power of this all-metal machine and it is stated that 180 h.p. can be developed. The machine is designed to carry 16 passengers. Photographs or further details of the aeroplane are not yet available but certainly if the machine actually accomplishes all that its sponsors claim for it nothing less than a revolution in aircraft design appears to be indicated, most British aeronautical engineers, however, hold rather sceptical views upon it.

Supermarine "Southamptons" for Argentina

A contract for six Supermarine "Southampton" flying-boats fitted with Napier "Lion" engines has recently been placed by the Argentine Navy. Five of the machines are to be of the wooden-hull type, but the sixth will be of the metal-hull type similar to the machines that were so successful on the Far East cruise. The Imperial Japanese Navy has also placed a contract for a metal-hull "Southampton," and if this boat proves satisfactory, a further contract may be placed.

One of the Pioneers



An early engine-driven machine used by the Wright brothers

THIS MONTH'S AIR STORY

A "Handley-Page" and an "Argosy" were talking together in a hangar. Suddenly the "Argosy" shivered.

H.P. (sympathetically):—"Got a cold, old chap?"

Argosy:—"No, I think it's one of those 'Moths' walking down my back."

Girl Pilot's New Record

A 17-year old girl, Miss Eleanor Smith, recently succeeded in attaining a greater altitude than had ever been reached previously by a woman pilot flying solo.

Her flight was made on 21st August over the Curtissfield Aerodrome, New York, and the altitude reached was 11,663 ft., over two miles. During the course of her flight Miss Smith had no idea how far she had climbed, for her altimeter failed and the result of her attempt on the record was not known until her sealed barograph had been calibrated.

Landing to Music!

The Air Ministry have recently drawn the attention of operating firms to "Notice to Airmen," No. 95, of the year 1927. In commenting upon this "*The Aeroplane*" writes:—"We are delighted to have such a romantic notice rescued from oblivion. Part of it reads as follows:

'An aircraft wishing to land at night (Argosies have wills of their own it seems) without being compelled to do so, on an Aerodrome having a ground control, shall before landing make intermittent signals, either with a lamp or a projector other than the navigation lights, or with any sound apparatus.'

"It is to be expected that most pilots will turn down the lamp or projector as a means of signalling in favour of the musical instrument of their choice, and will teedle around our Aerodromes at night seeking to signal soothingly to the notoriously savage-breasted ground staff with lute, Jew's-harp or oboe. This they will do intermittently until the control tower responds with fife, fiddle or big bassoon. Should they obtain no musical encouragement, they will mournfully fly away to some more cultured Aerodrome a couple of hundred miles away, possibly murmuring to themselves some such words as these:—

'With dulcimer we signalled them,
And loudly twanged the zither,
But all the witless ground staff did
Was leap about and dither.'"

* * *

New Cirrus Engine

The A.D.C. Aircraft Limited, who are the manufacturers of the famous Cirrus engines, have recently produced a Cirrus Mark III engine. The Cirrus engine was originally constructed to develop from 26 to 60 h.p., but when the Mark II engine was introduced it was rated at 30-80 h.p. The power of the Mark III engine has been increased to 85 h.p. at 1,900 r.p.m. and 95 h.p. at 2,100 r.p.m. The petrol oil consumption of the new engine is identical with that of the Mark II model, but the weight per horse power is less. The new engine is suitable for use in either aeroplanes or seaplanes, and will give a more rapid take-off and an improved rate of climb. The Mark II and III engines are equally priced, and the earlier type can be brought up-to-date at a moderate cost.

The Start of a Great Adventure

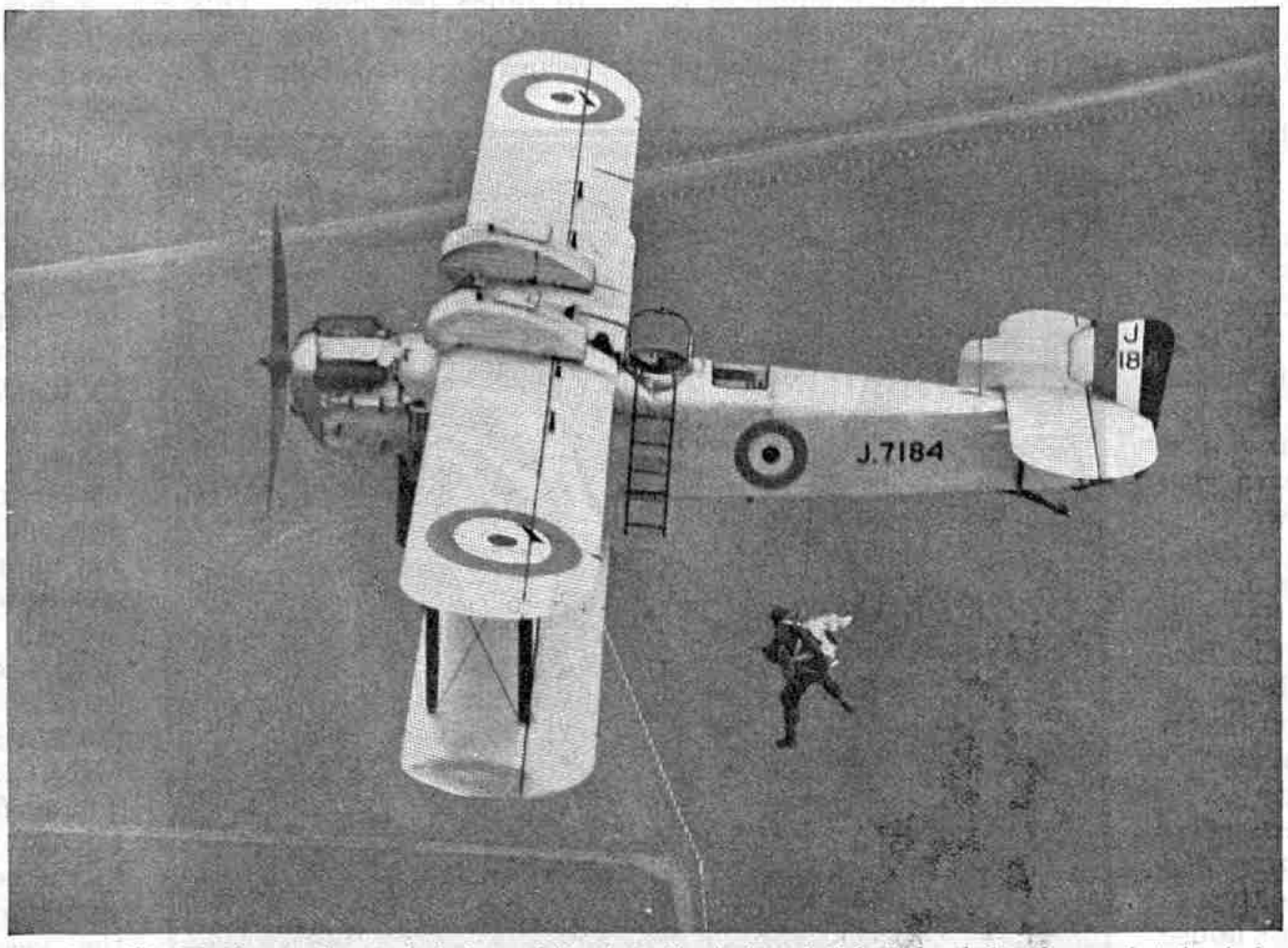
An impressive demonstration of trans-continental flying was recently inaugurated by Lieut. G. A. Koppen, the famous Dutch pilot. Flying an Armstrong Siddeley three Lynx engined Fokker VII-3m, he started on the first stage of the 8,750 miles journey from Amsterdam to Batavia. Several other machines were scheduled to leave at intervals of one week and on arrival at Batavia to undertake postal services on behalf of the I.L.M. (Indische Luchtvaart Maatschappij), a concern allied with the K.L.M. Royal Dutch Air Lines. Next year the Amsterdam-India-Batavia service will be developed still further.

The Fokker machines, which carry two pilots and an engineer, possess certain new features, the most interesting of which are the large diameter landing wheel brakes. These brakes are of the enclosed expanding type similar in design to those used on motor cars. The brake lever is compensated and located between the two pilots, and is connected to the tail skid to enable the machine to be turned quickly on the ground by braking the wheel on the inside of the turn. It is stated that its application reduces the run of the machine on the ground from 250 to 100 yards and that the operation is so gradual that there is no chance of the machine pitching. The wheels are fitted with Goodrich tyres and run on roller bearings. The cabin ventilation is controlled from the interior.

The Armstrong Siddeley engines with which the machines are equipped are the standard seven-cylinder, air-cooled radial Lynx type, which develop 200-225 h.p., and the same type of engine was used by Lieut. Koppen on his experimental record-breaking Amsterdam to Batavia and back flight, last year. Its success on that occasion largely accounts for its selection for the new service.

The latest engines are fitted with metal propellers, the wing engines using two blades and the central engine three. A top speed of approximately 120 miles per hour, a cruising speed of 104 miles per hour and a landing speed of 61 miles per hour indicate the capabilities of the machines.

When you *don't* "look before you leap!"



Jumping off! The observer is seen just clear of the plane, the photograph being taken before the parachute has had time to open. (This illustration, and the one on the previous page, is taken from "The Wonder Book of Aircraft," by permission of the publishers)

An Adventurous Holiday

Lieut. Commander H. C. MacDonald, D.S.C., R.N., recently undertook a solo air tour covering France, Italy, Egypt, Arabia, Mesopotamia, Palestine and Syria, after having previously flown solo for only eight hours. Commander MacDonald is an owner-pilot and he left Stag Lane in his own D.H. Moth, arriving at Paris on the evening of the same day. After a short stay he made for Naples via Dijon, Marseilles and Pisa. From Naples the journey was continued to Benghazi by way of Malta and Tripoli, and then through Cairo and Amman to Rutbah Wells.

From Rutbah Wells a 600 miles car trek to Baghdad and back was necessary for elevator repairs, but eventually the machine was repaired and flown to Baghdad. From here the return flight began by way of Deirez-zor, Aleppo and Aboukir. After leaving Aboukir, Commander MacDonald was flying over the Bay of Sollum when the engine gave out, and he was forced to glide to the shore and make a landing. While working on the engine a crowd of Arabs appeared, and when the engine was again in working order the Commander took off. In order to amuse the spectators he pretended to crash, but unfortunately the pretence was a little too realistic, and the machine hit a boulder! A message was sent to the nearest Italian outpost and the Commander was escorted to the Arab camp where a council of war was held to determine what should be done with him. The following day some Italian officers arrived and he was taken to Sonnen, from where he reached London via Alexandria.

Five Thousand Miles in 4½ Days

The 5,000 mile journey from Karachi, India, to England, was recently accomplished in four-and-a-half days by two British airmen—Captain Barnard and Flying Officer Alliott. The two aviators left England flying the Fokker monoplane "*Princess Xenia*," fitted with a 450 h.p. Bristol Jupiter radial air-cooled engine, and carrying the Duchess of Bedford as a passenger. Their object was to attempt to fly to India and back in 10 days. Unfortunately the machine developed engine trouble at Bushire, Persia, and a delay of 12 days was occasioned pending the arrival of a new engine from England. Adverse weather conditions and bad sandstorms were experienced on the journey from Bushire to Karachi, and a new propeller had to be sent from England before the return flight could be undertaken.

On the return journey Captain Barnard carried a large case of tea as cargo, in order to demonstrate that the transport of merchandise by air is quite a practical proposition. The object of the whole flight was to show that a rapid air service between India and England is perfectly possible with present day aircraft.

It is very probable that a regular air service between Karachi and India will soon be set up, the period of 4½ days taken in this record-making flight comparing favourably with the three weeks occupied on the same journey by a fast mail steamer.

* * * *

Air Force Cross for *Southern Cross* Aviators

Captain Kingsford-Smith and Mr. Ulm, the two Australian aviators whose flight across the Pacific Ocean was mentioned on this page last month, recently flew from Sydney to Melbourne in the *Southern Cross*, carrying Captain Kingsford-Smith's mother and Mrs. Ulm as passengers. They received a great ovation and a civic welcome at Essendon, and upon arriving at Canberra, the Federal capital, were presented with £5,000, the gift of the Commonwealth.

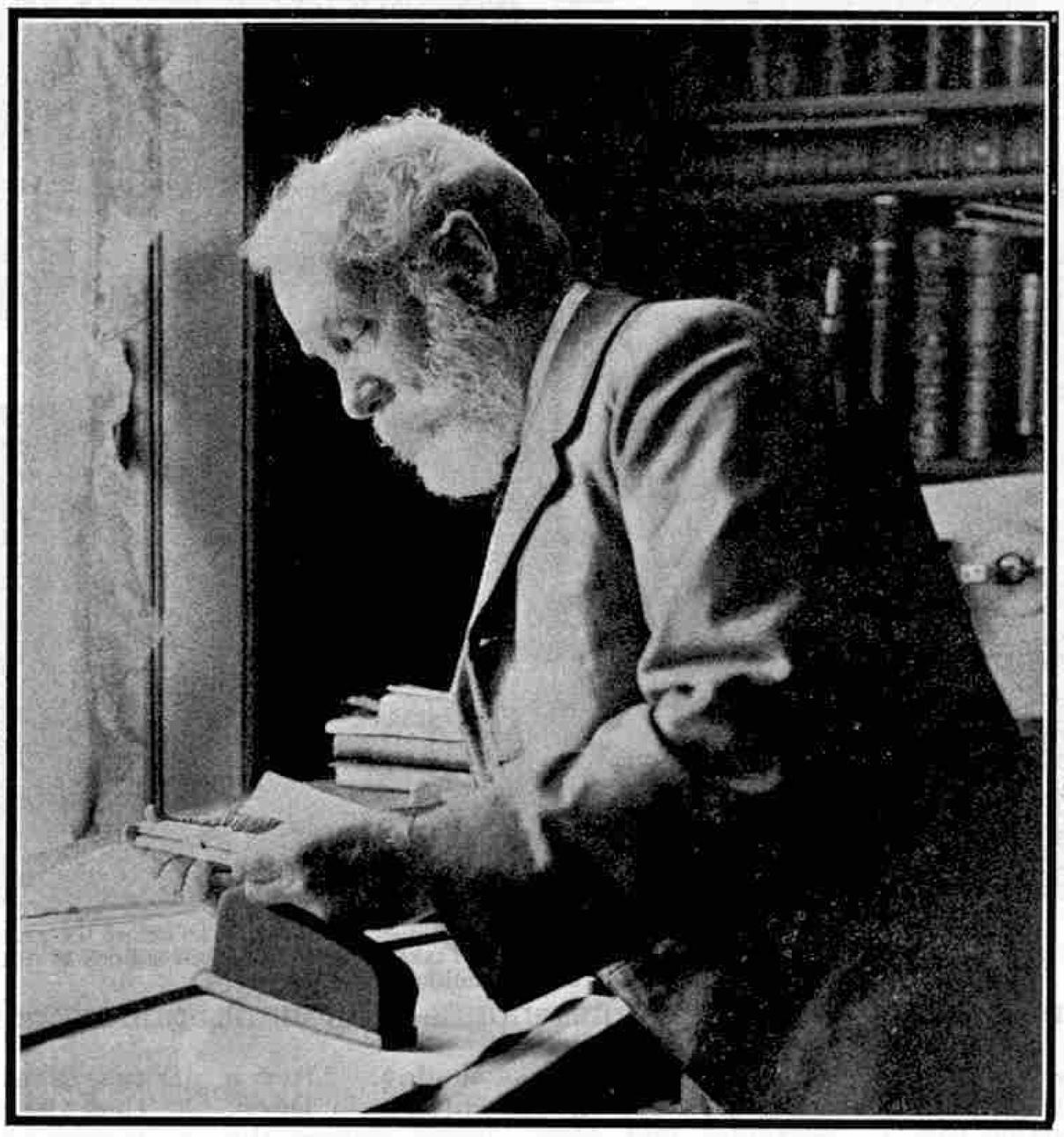
Captain Kingsford-Smith and Mr. Ulm have both been awarded the Air Force Cross by His Majesty the King.

The Late Sir John I. Thornycroft

A Pioneer in the Building of Swift Destroyers

AN interesting chapter in the story of the development of high speed on both land and sea is recalled by the announcement of the death at the age of 85 of Sir John I. Thornycroft, the founder of a firm that acquired an international reputation for building speedy vessels of the destroyer type, and later became equally prominent in the construction of motor vehicles.

Sir John Isaac Thornycroft was born at Rome in 1843. His father was a distinguished sculptor, and in view of the prominence achieved by the son in engineering it is interesting to learn that the father also was of a mechanical turn of mind and had made many experiments with farming machinery on the Cheshire farm that had been his home. It was no doubt the influence of his father that turned Sir John's mind towards engineering, and it is recorded that his first boat was built at his father's house while he was still practically a boy. The "*Nautilus*," as the boat was called, showed many original features, the most notable being that the propeller shaft was inclined downward at a considerable angle to enable a propeller of exceptional size to be fitted.



Sir John Isaac Thornycroft

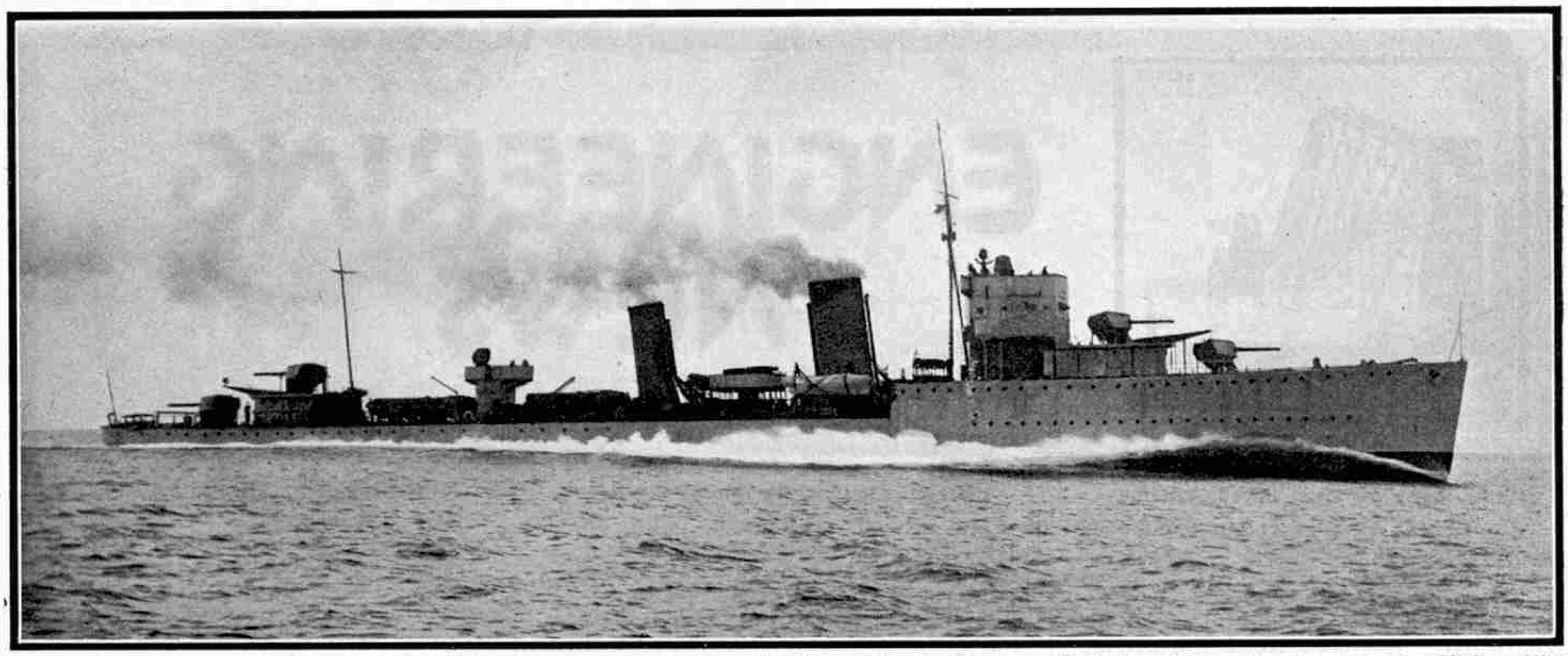
The "*Nautilus*" proved so successful that the elder Thornycroft was encouraged to establish his son as a boat-builder in a yard on the banks of the Thames at Chiswick. Sir John was then only in his twenty-third year, but he built several launches that proved as successful as his first boat and eventually established himself as a ship-builder of the highest promise. To gain experience he went to Jarrow, where he worked in Messrs. Palmer's shipbuilding yard, and later to Glasgow. It was in the latter city that he received the scientific training that he turned to such good account in later years. He studied under Lord Kelvin at Glasgow University, and spent a considerable time in the yards of the Fairfield Shipbuilding Company, where he concerned himself not only with the practical details of his chosen craft but also with researches and experiments designed to bring about improvements.

Returning to Chiswick he settled down to steady work, concentrating chiefly on the production of high-speed steam launches. The vessel that first brought him into prominence was the "*Miranda*," a launch 50 ft. in length built in 1871, that attained a speed of 18 miles per hour. This was a remarkable speed at the time, but young Thornycroft soon eclipsed his own record by producing the "*Gitana*," a larger vessel of 84 ft., the engines of which developed 450 h.p. and propelled the craft at a speed of 22 m.p.h.

A third boat that was completed immediately afterward effectively established the reputation of the Thornycroft yard and at the same time started Sir John on his career in the branch of shipbuilding with which his name will always be associated. This was the torpedo boat "*Lightning*," completed in 1876. It was of 27 tons displacement and was capable of a speed of 18 knots. These figures may not appear remarkable, but in the course of the construction and trials of the vessel her designer acquired important information on hull form and propeller design that enabled him to effect great improvements in later vessels.

He was not satisfied with the form of hull then in general use, for instance, and after many trials adopted the now common flat, wide form of stern under water, with the propeller shaft inclined downward and rudders on each side. The propeller, too, underwent many improvements at his hands. In later stages of his career he built a special tank in which to carry out tests. No such tank was available when he commenced his experiments, however, and in order to acquire the necessary information on the performance of propellers he adopted the ingenious device of fitting those under trial ahead of his vessel, where they ran in still water.

The greatest engineering triumph of his career was the successful application of the water-tube boiler to marine work. All previous attempts to use this type of boiler on boats had failed and the locomotive type was regarded as the only satisfactory form. Sir John's proposal to fit a gun-boat in 1893 with tubular boilers of his own design was only accepted because of his great reputation, and failure was freely prophesied. The boat so fitted was the "*Speedy*," one of a class of gun-



H.M.S. "*Amazon*," Britain's largest and fastest post-war destroyer, built by John I. Thornycroft & Co. Ltd. at Southampton in 1927. This vessel is 311 ft. 9 in. in length, has a displacement of 1,330 tons and a speed of 37.96 knots

boats of approximately 800 tons displacement. All other members of the class were fitted with locomotive type boilers and a direct test of the efficiency of the Thornycroft design was thus possible.

The test fully confirmed Sir John's confidence. The engines of the "*Speedy*" developed 4,700 h.p. against the 3,500 h.p. of her sister vessels, and attained a correspondingly greater speed. This triumph led to the wide adoption of Thornycroft water-tube boilers on vessels of all sizes throughout the world and was the beginning of the movement that has resulted in the almost complete abandonment of the type then in general use.

The wonderful reputation for speed and efficiency of the boats launched from the now famous Chiswick yard led to great developments of the work carried on in it, especially in connection with the construction of torpedo boats and destroyers. Eventually it was found necessary to move to roomier quarters and in 1903 the works were transferred to Southampton.

From the new yard a constant stream of destroyers and other fast craft was produced. The war record of Messrs. Thornycroft is particularly interesting. Besides speeding up work on the type of vessel for which the yard was already famous, the construction of submarines was undertaken. Three of these vessels were completed, in addition to 29 destroyers and flotilla leaders, while more than 500 vessels of all kinds passed through the repairs department. Another interesting feature of the work of the firm during the War was the proposal to build decoy ships of shallow draught that should be comparatively safe from destruction by torpedoes. This proposal was made at a very early stage by the firm and was accepted by the Admiralty. Three vessels were completed in 1916, and the part played by these and similar vessels in the struggle with German submarines is now well known.

The possibilities of road traction were appreciated by Thornycroft in the closing years of last century and his pioneer work on motor vehicles was rewarded in 1901, when he won a prize of £500 that was offered by the War Office for the best example of a motor-driven vehicle for military purposes. This branch of his work was greatly developed in later years and the name Thornycroft is to-day as well known in motor engineering circles as in the ship-building world.

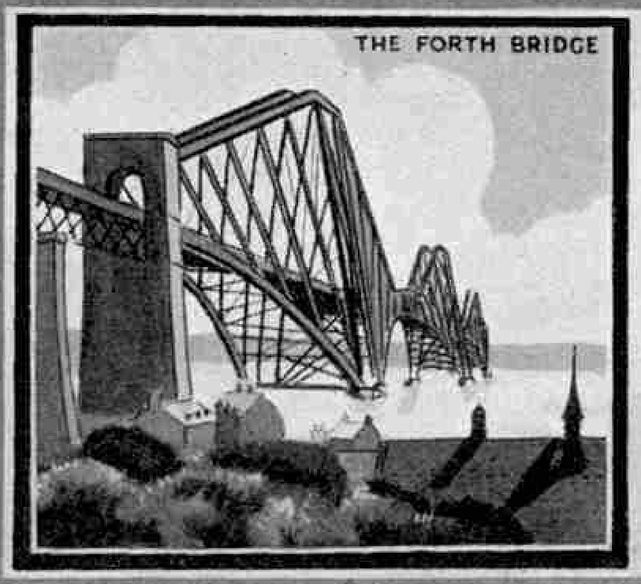
Throughout his long and active career Sir John continually made extensive experiments in all branches of shipbuilding science and was always distinguished by the generosity with which he disclosed to others the valuable information thus obtained. He was knighted in 1902 and received many other honours at various times, but perhaps the greatest compliment paid to his abilities was the invitation extended to him in 1905 by the Admiralty to serve on a committee appointed to consider the design of large war vessels. It was this committee that recommended the building of the first "Dreadnought," and thus Sir John helped to found a new era in naval construction, in addition to taking a very prominent part in the development of shipbuilding science in general.

It has been said that Sir John's life history might be read at the Patent Office and there is some truth in this, for in a period of just over half a century he himself took out over 50 patents and his name was associated with many others. These patents covered a very wide range of subjects, and they show that Sir John's industry must have been enormous. He was particularly interested in experiments on hull forms and, as already stated, he constructed a tank specially for this work. A great deal of valuable information was gained as the result of these experiments. In particular the experience gained proved to be of very great service in the design of the coastal motor boats that were built by his firm during the war for the special purpose of meeting the submarine menace.

In the midst of all his engineering activities Sir John managed to find time to prepare and contribute numerous papers to the various societies to which he belonged, and many of these papers broke new ground and exerted very great influence in the field of marine engineering.

In character Sir John was forceful and determined, yet kindly and considerate. In common with most men who have achieved great things as engineers, he was himself a first-class all-round mechanic. He was, quite naturally, impatient of any work that was not of the highest perfection, and it was by no means an unusual thing for him to take a tool from a workman who was not proceeding to his satisfaction and show him how the job really ought to be done.

Sir John's death occurred on 28th June last at his home in the Isle of Wight.



ENGINEERING NEWS

Major Segrave's Next Speed Attempts

Major H. O. D. Segrave has announced his intention of attempting to regain the world's motor car speed record for Great Britain, at Daytona early next year. Major Segrave's car is at present being constructed at Robin Hood Engineering Works, Putney Vale. It has a cigar-shaped body, 28 ft. in length and 24 in. in breadth, and is fitted with a 1,000 h.p. Napier engine. The machine is to be named the "*Golden Arrow*," and to conform with its name will be painted gold. Major Segrave hopes to attain a speed of at least 240 miles an hour in his new car. The motor speed record at present is held by an American, Day Keech, who attained a speed of 207.55 miles per hour.

In addition to his attempt upon the motor car record, Major Segrave intends to try to beat the world's speed record for motor boats. His boat is now under construction at the works of the British Power Boat Company at Hythe, Southampton, from where it is expected to be launched early in December. The present record of 90 miles an hour is held by America, but Major Segrave's boat has been constructed to attain 95 m.p.h. If he succeeds it will be the first time for seven years that England has held this record.

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Petrol Store for Ellesmere Port

A large public petrol store, the only one in the north-west of England, is to be constructed at Ellesmere Port in the near future. Ellesmere Port is a small town near Liverpool, and lies on the Manchester Ship Canal. It will be possible to store approximately 12,000 tons of petrol at this depot, and as full-sized tank ships can reach the Port along the Ship Canal, the store will provide a very fine distributing centre for companies marketing petrol in the North of England.

* * * *

New Tin Smelting Works Opened

An interesting recent event was the opening of the Penpall Tin Smelting Company's new works at Bootle, near Liverpool. The works are 4½ acres in area and are able to deal with from 1,000 to 1,200 tons of ore in a month. A small quantity of the ore smelted is obtained from Bolivia but the greater part comes from sources within the British Empire. The storage sheds are capable of containing 3,000 tons of ore and the most up-to-date and efficient machinery is provided throughout the works. The machinery includes a Stag Ball Mill, two Knight automatic motor-driven sampling machines, and a Knight packet splitter.

Diesel Engines for Motor Lorries

The Royal Automobile Club have subjected to a series of official tests a German motor lorry fitted with a Mercedes-Benz-Diesel engine. The principle involved is not new as many of these engines have been in use for some years on ships, in electric lighting plants and elsewhere. The only novelty lies in its adoption for motor transport.

Some of the main advantages of these engines are that they may be run on crude, or even waste oil, from which the petrol has been extracted. This oil can be obtained for about 3d. or 4d. per gallon. Carburetters, magnetos and sparking plugs are not required, and as the oil is not readily inflammable the danger of fire is greatly reduced.

As in the ordinary type of Diesel engine a spray of oil is forced into the cylinder, which has previously been charged with air at high pressure. The upward movement of the piston compresses the air in the cylinder still further. The rise in pressure causes a rise in temperature that is sufficient to cause the ignition of the oil upon entry. The usual pressure in the cylinder when the oil is introduced is about 300 lb. per sq. inch—a pressure three times as great as that in the cylinder of a petrol engine.

The lorry and trailer tested by the R.A.C. was run 51½ miles at an average speed of 7.9 miles an hour with a total running weight of 19 tons 15½ cwt. and a load of 19 tons 5½ cwt. The fuel consumption was 6.58 miles per gallon, which equals 80.8 ton miles per gallon for the paying load, or 130.2 ton miles per gallon for the entire running weight.

* * * *

Floating Dock for Persia

A floating dock built for the British Tanker Company was recently launched from the yards of Sir W. G. Armstrong, Whitworth & Company Limited. The dock is of the double-sided, self-docking or sectional pontoon type, and consists of a lifting portion attached to two parallel side walls. The length of the dock over the platforms is 194 ft. and over the pontoon 172 ft. 11 in. The overall width is 61 ft. 3 in. and the overall dimensions of the side walls are 152 ft. 1 in. by 19 ft. 7 in., by 6 ft. 3 in. The minimum depth of water in which the dock may be used is 22 ft., and in fresh water a vessel with a displacement of 750 tons can be lifted. The pumping plant consists of two centrifugal pumps operated by semi-Diesel engines. These pumps would take two hours to lift a vessel with a displacement of 600 tons and a mean draught of 10 ft. The dock is intended for service at Abadan, Persia.

Atlantic Crossing Record Again Broken

The "*Mauretania*" has again broken her own world record run across the Atlantic. She completed the 3,096 miles between Cherbourg and New York in five days, two hours and thirty-four minutes, thereby beating her previous record by forty-three minutes.

* * * *

Wireless Lighthouses

The Marconi Company are at present engaged in installing seven coastal beacon transmitters at various points around the British coast. These are at Start Point, Lundy Island, Sale Skerry, Dungeness, South Bishop, Kinnaird Head and Cromer. Wireless beacons are also to be constructed at Tory Island and Mizen Head.

* * * *

A Two-Ton Glass Casting

One of the trickiest pieces of work that the engineers of the United States Bureau of Standards have ever been called upon to perform was completed recently. The task consisted of the making of a great astronomical reflector. The work commenced in May last year when the engineers made the casting, a two-ton disc of glass. This required eight months to cool, but when it was examined at the end of that period it was found to be as free from defects as the finest optical glass. The stresses that had developed were almost negligible.

The most difficult part of the work came when the engineers undertook to cut from the middle of the casting a 50 lb. cylinder, which had to be prepared with minute precision, so that its edges should be free from chips and cuts. The work could only be carried out at the rate of an inch a day, but ultimately was completely successful.

Many previous attempts to cast such a reflector have been made but all have ended in failure.

* * * *

North Wales Power Scheme

The North Wales Power Company's scheme for supplying a 66,000 volt electric current to the towns and industries of North Wales has recently been completed after three years' work. The plans called for the construction of five concrete dams near Maentwrog in order to provide a lake with a total water surface of two square miles. The largest of the five dams is 100 ft. in height, holding back 1,200,000,000 cubic feet of water. In order to carry water from the main dam to the Maentwrog power-house, a distance of two miles, a pipe-line 9 ft. 6 in. in diameter had to be constructed, passing right through two hills on the way. The undertaking has cost approximately £2,000,000.

A New Type of Gear Box

Perhaps the most remarkable thing about the modern motor car is that the gear box invented by Panhard more than 30 years ago is still used, in spite of its obvious deficiencies. The inventor himself was convinced that his gear box was only a makeshift, as it is not sound engineering practice to intermesh two gear wheels while both are rotating at high speed. No really satisfactory substitute was forthcoming, however, and much time and thought have therefore been spent on improving it. As a result, very few cars have been fitted with a gear box of any other type.

Recently the efforts to produce a gear box of simpler type have been renewed. The Armstrong Siddeley Motors Ltd. have conducted secret experiments to this end and after five years' work have evolved one in which the gear wheels are concentric and always in mesh. In addition, the pressure between the teeth is less than in the older type, as the number of teeth in engagement is increased. The gears are therefore much less noisy.

To drivers the most interesting feature of the device is the control. As the gear wheels are always in mesh, no long lever is required to slide them about. Instead, the usual clutch pedal is replaced by a special one and a short selector lever is mounted in a dial above the steering wheel. The dial carries marks to show where the lever should be placed to be in neutral or to select any gear. The movement of the lever does not bring the gear into operation and to do this it is necessary to press the control pedal to its greatest extent and release it.

A very short time only is required to move the selector lever and to make the necessary movements with the pedal. Changes of gear may thus be made with startling rapidity in dead silence, as many as 15 changes being possible in 10 seconds.

The new gear box has passed the experimental stage and is to be used on several Armstrong Siddeley models. One car fitted with it has already covered more than 50,000 miles without any adjustment being required. It seems therefore, that driving will be freed from one of its greatest terrors. It will no longer be necessary to acquire the difficult art of timing the engagement of gear wheels, and gear changing promises to be as easy and mechanical as steering or braking.

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Brazilian Motor Bus Service

The first Brazilian long-distance motor bus service to be run regularly was recently inaugurated between Rio de Janeiro and Sao Paulo. The distance between the two places is 300 miles and the bus takes 14 hours to complete the journey, passing through the greatest coffee-producing area in the world on its way. This crop has made Sao Paulo the third city in South America.

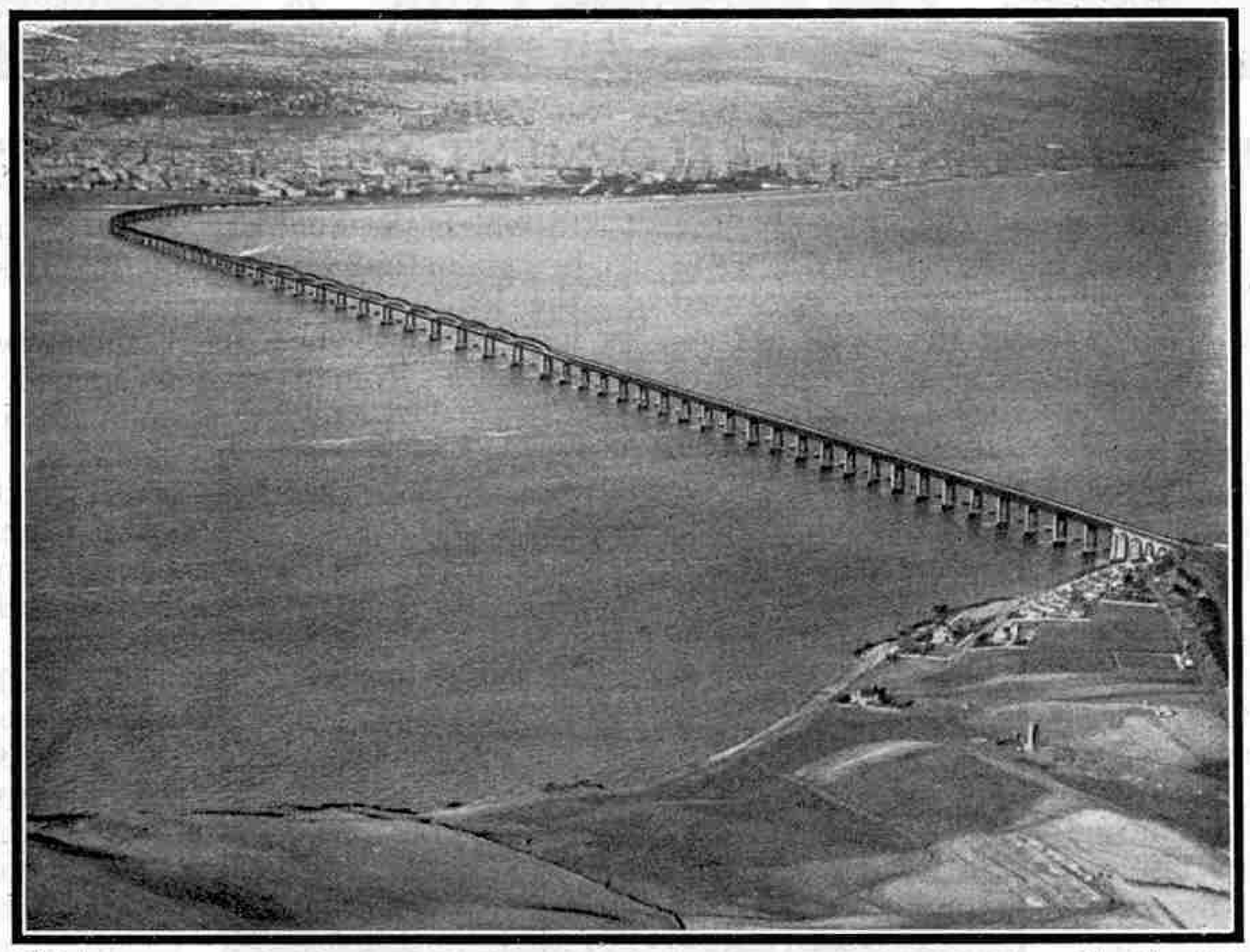
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Tunnel Under the Detroit River

According to an announcement by the Detroit and Canada Tunnel Company, the construction of the first section of the international tunnel under the Detroit River is now in progress. Four sections will be put in place this year and the entire work is scheduled for completion in 1930. The structure is stated to be the first under-water vehicular tunnel to connect two nations. The cost, with terminals, is estimated at over £5,000,000.

Another big highway project connecting the Cities of Windsor and Detroit is the Ambassador Bridge. The expenditure involved in the construction of these two engineering works is approximately £9,800,000, and they are welcomed as an expression of faith in the continuance of good will between Canada and the United States.

Bridges from the Air: No. 5



Photo] [*Aerofilms Ltd.*

The Tay Bridge, a lattice girder structure of 85 spans, is 3,593 yards in length and has the distinction of being the longest railway bridge in the world. It was built to replace the ill-fated structure that collapsed on 28th December, 1879, after an existence of barely a year.

The designer of the bridge had not made sufficient allowance for wind pressure, and in a terrific gale, during which it was estimated that the pressure was at times as great as 40 lb. on the square foot, the bridge collapsed while a train was passing over it. The train was hurled to destruction into the water below and over 80 lives were lost.

Railway Bridge over Saskatchewan River

The Canadian Pacific Railway Company are expected shortly to undertake the erection of a large steel bridge over the Saskatchewan River at a point north of Nipawin on the Tisdale subdivision.

The proposed bridge will be 1,840 ft. in length, with an approximate height of 150 ft., while there will be 15 spans, the four at the centre of the structure being each 280 ft. in length. The bridge will be a double-deck structure, with provision on the lower deck for a 16 ft. highway.

More than half of the Province of Saskatchewan lies to the north of the Saskatchewan River. Rail transportation is at present limited to the lines of the Canadian National Railways north and west of Prince Albert in the westerly half of the Province, where agricultural development has been the keynote in the expansion of railroad facilities. The Flin Flon railway, on which construction is rapidly proceeding, will also bring rail transportation to the Flin Flon mining area on the boundary between Manitoba and Saskatchewan.

The projected bridge would bring the Canadian Pacific Railway into the northern hinterland at a point approximately 75 miles east of Prince Albert and halfway to the eastern boundary of the Province. It would tap agricultural lands along the Whitefox River as an immediate objective, and beyond are the vast possibilities in mineral development of the north-eastern or pre-Cambrian area of the Province.

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Modernisation in Baghdad

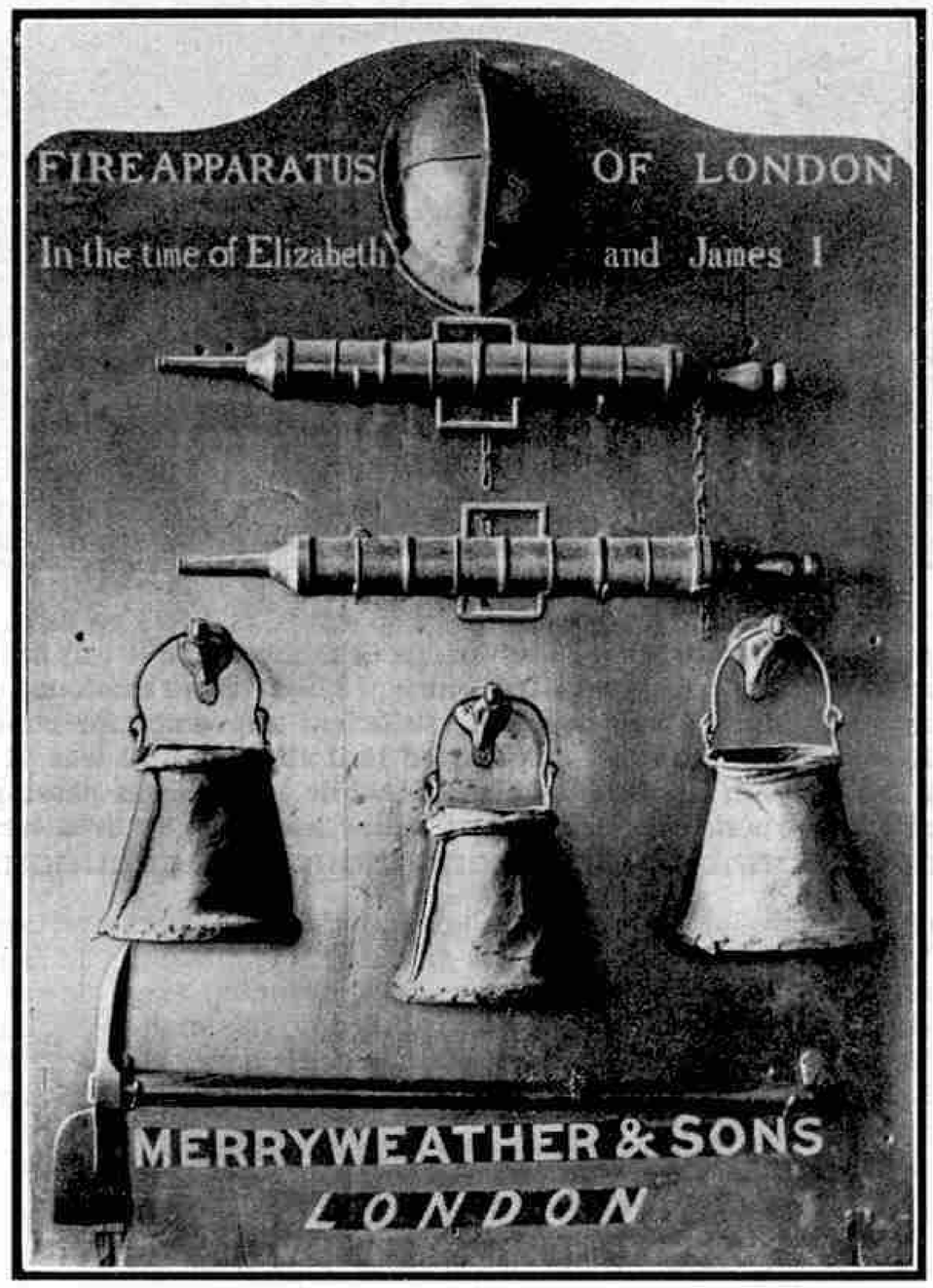
The Iraq Chamber of Deputies have passed a Bill that grants a 50-year concession to a British syndicate to provide Baghdad with electric light and a tramway service. Baghdad lies on the River Tigris and was once the capital of the ancient Saracen Empire. It was founded in A.D. 762, and from A.D. 786-809 Haroun-al-Raschid ruled over the city. It was captured by the Moguls in 1258, but after changing hands once or twice it remained in the possession of Turkey until lost by them in the Great War. It is now the capital of the independent Kingdom of Iraq, and has a population of about 120,000, but the city has not changed a great deal since the time of Haroun.



VII.—THE ORIGIN AND DEVELOPMENT OF THE FIRE ENGINE

FROM the very earliest times the phenomenon of fire must have been familiar to man. He saw, for example, the terrible destruction caused when lightning struck a tree and set the forest ablaze, and for a long period this sight must have filled him with unreasoning terror. By degrees familiarity would lessen man's fears and he would arrive at the stage at which, although still regarding fire with respect and awe, he could watch it without panic and could therefore begin to form his own conclusions as to its nature. Then came the time when, probably by accident, man discovered that he could bring fire into being by his own efforts. When or how this discovery was made, whether in one place or in many, we shall never know.

The knowledge that he could produce fire at will must have given primitive man a new feeling of power and we can imagine him carrying out all kinds of experiments with the eagerness of a child with a new toy. It would not be long, however, before he found that it was dangerous to let his fire get out of hand—in other words he made the discovery that fire is a good servant but a bad master. From that time along with the steady development of quicker and more reliable means of producing fire there would be attempts to devise methods of dealing with a fire that had passed the bounds of safety and had become a menace to property and even life.



Fire-fighting apparatus in use in the time of King James I. For this and other photographs illustrating this article we are indebted to Merryweather & Sons Ltd., London

The first fire-fighting appliance for domestic use appears to have been a sort of squirt consisting of a leather bag attached to a long metal pipe. The bag was filled with water and then by applying pressure to its sides the water was forced through the pipe in the form of a jet. The distance to which this jet could be thrown varied with the extent of pressure upon the bag, but in any case it was strictly limited, in addition to which the quantity of water that could be handled in a given time was very small. In spite of its inefficiency the leather squirt remained the most effective fire-fighting appliance until somewhere about 200 B.C. when a Roman citizen named Ctesibius, invented an engine incorporating a hand-operated pump, which had much greater possibilities.

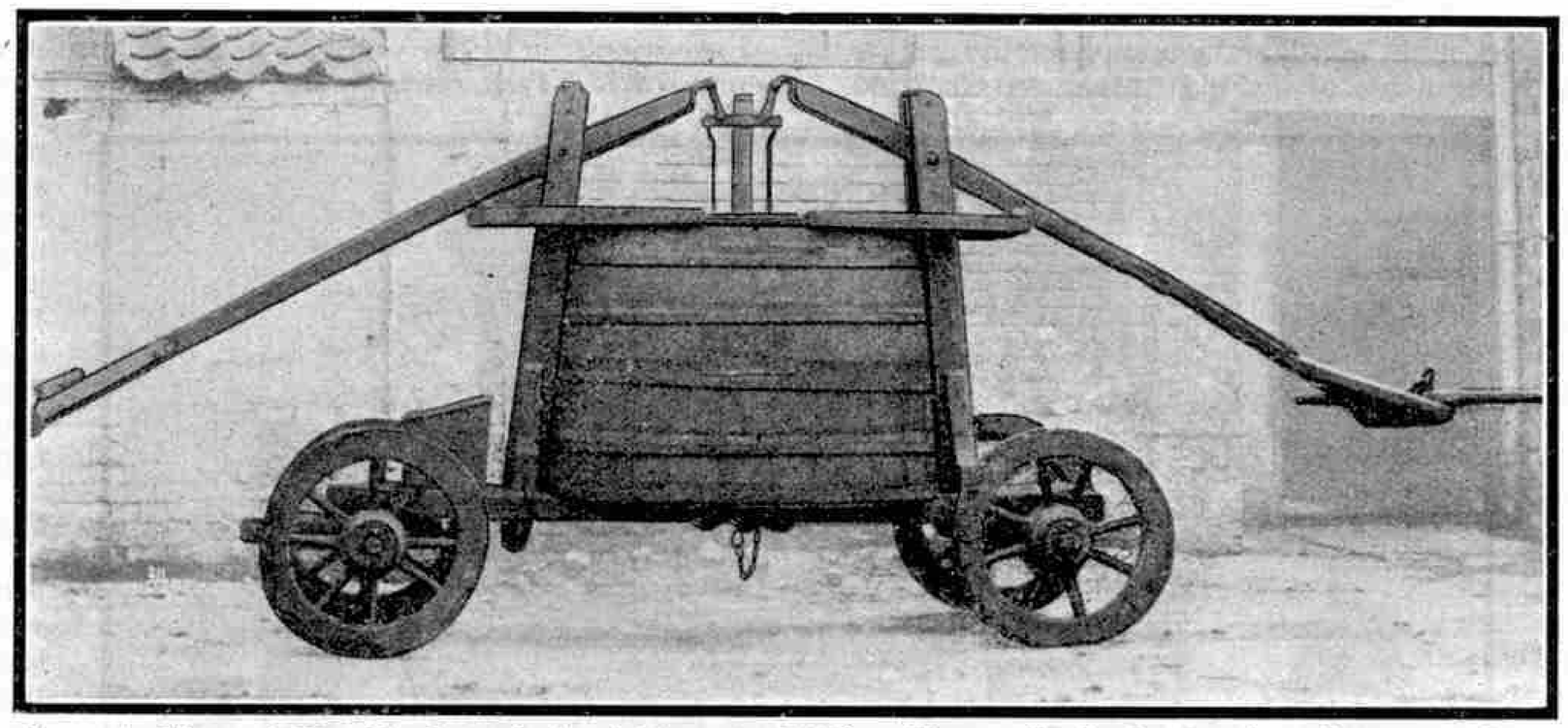
An ancient description of this invention tells us that the cylinders and valves of the pump were made of brass while unshorn sheepskin was utilised as packing for the pistons. Between the cylinders was a basin or chamber having "a cover like an inflated funnel . . . . which is adjoined and fastened to the basin by a collar rivetted through, and on the top of it, a pipe called the tuba is affixed perpendicularly." The cylinders were fitted with pipes that led to an intermediate chamber. "At the upper holes of the pipes within the basin," continues the description, "are made valves, hinged with very exact joints, which, stopping the holes, prevent the efflux of the water that would be pressed into the basin by air . . . the buckets (cylinders) have valves placed below the lower mouths of the pipes and fixed over holes that are in their bottoms."

The cylinder pistons were worked up and down by means of levers from above, each downward stroke "pressing the air therein contained with the water through the mouths of the pipes into the basin, from whence rising to the cover the air presses it upwards through the pipes." This engine required two men to operate it.

Outbreaks of fire were very frequent in ancient Rome, especially in the poor and densely populated parts of the city where most of the houses were of wood. The streets were so narrow that, with the poor apparatus then available, it was almost impossible to prevent a conflagration at one side of a street from bridging the

roadway and igniting the property immediately opposite. The small "sanctuary" fires that were kept burning day and night in every home added further to the risk of serious outbreaks.

The Romans seem to have been pioneers in the matter of fire-fighting equipment, for we are told that their firemen were equipped with hammers, mattocks, and lengths of leather hose for use with the engine. They also had scaling ladders and pillows on to which people trapped by the fire could leap. The firemen who were not otherwise engaged were provided with light vases with which they relayed supplies of water to feed the engine.



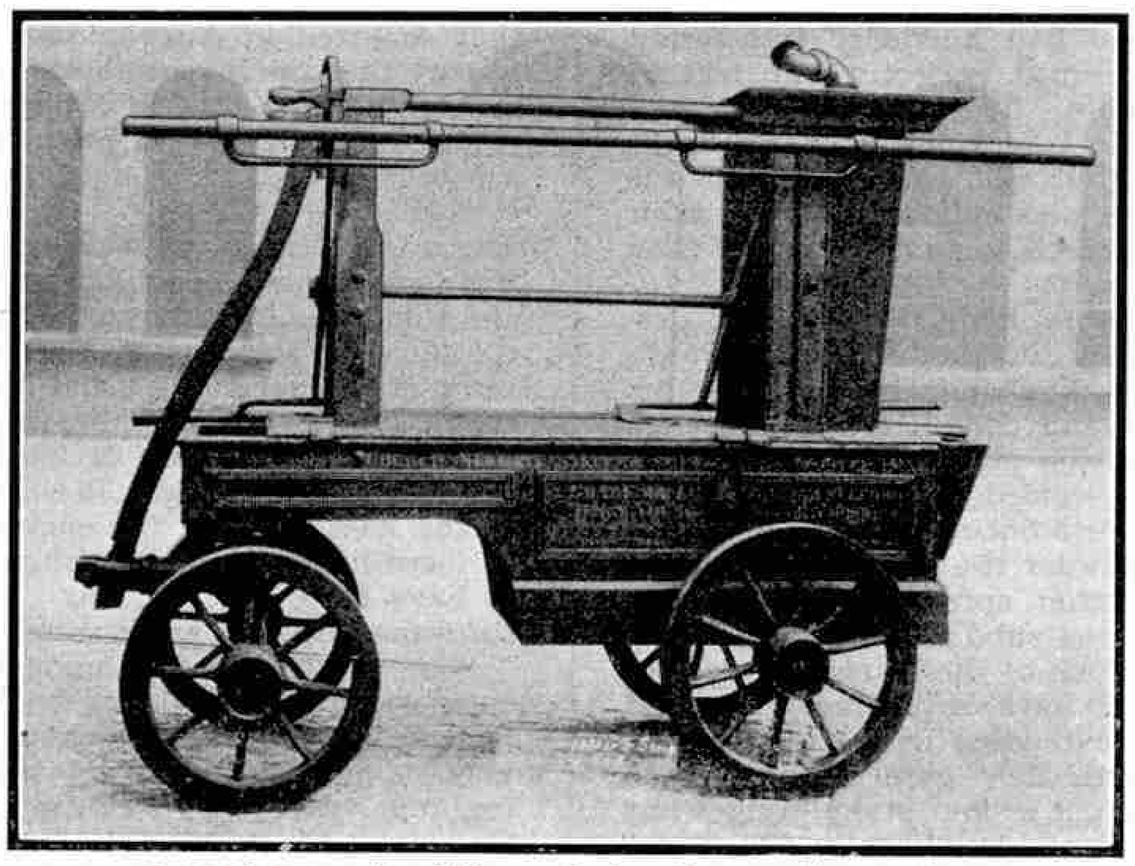
A crude Manual Fire Engine of about the year 1678. The method of operating the pump from each end of the engine is clearly seen

During the reign of Augustus serious outbreaks of fires became so prevalent in Rome that many of the wealthy inhabitants engaged watchmen to guard their mansions at night, while to allay public fears the Emperor established a "fire watch" to protect the city. One of the worst of the many great fires in Rome occurred in 44 B.C. and gutted the famous law temple known as the "Basilica Julia," a magnificent structure designed by Julius Cæsar and completed by Augustus. Another terrible fire broke out in 64 A.D. and raged for three days, completely destroying a huge portion of the city.

During the period in which the historian Pliny was Governor of Bithynia, in the first century A.D., he was commanded by the Emperor Trajan "to provide such machines as are of service in extinguishing fires, enjoining the owners of houses to assist in preventing the mischief from spreading and, if it should be necessary, to call in the aid of the populace." In one of his letters to the Emperor, Pliny reported that the town of Nicomedia (in Bithynia) had been almost destroyed by fire "owing to the violence of the wind, and partly to the indolence of the people, who, it appears, stood fixed and idle spectators of this terrible calamity. The truth is," he added, "the city was not furnished with either engines, buckets, or any single instrument proper to extinguish fires, which I have now, however, ordered to be provided."

Hand squirts were introduced into England during the 16th century. These squirts were about 2 ft. in length and made of brass, and resembled the hand syringe used nowadays by gardeners. There were two handles at opposite sides and situated midway along the squirt, while a third handle, projecting from the base, operated a piston inside the vessel. The aperture in the nozzle for the emission of the water was $\frac{1}{2}$ in. in diameter. Three men were necessary to operate one of these squirts, two of whom held it by the side handles. As soon as the nozzle of the squirt was immersed in the leather bucket or other receptacle containing water, the third man drew out the handle attached to the piston rod. When the squirt had sucked up its full capacity of water, the two men lifted it up and directed the nozzle toward the burning property. The third man then drove home the piston, causing the water to be expelled with considerable velocity.

A book entitled "*A Treatise on Art and Nature,*" published in 1634 or 1635 by a writer named John Batt, mentioned "divers squirt and petty engins to be drawn upon wheeles from place to place for to quench fier among buildings, the use of which hath been found very commodious and profitable in cities and great townes." From this reference it is evident that, in addition to the popular three-handed squirt, some type of hand pumping engine was then in use, but Batt does not give any details of the machine. From 1650 onward hand-operated fire engines were produced by various inventors but most of them were of very crude design and construction, their only point of superiority over the hand squirt being their ability to project water to a greater distance. The lack of reliable hose made it necessary to draw the engine so close to a burning building that frequently the engine itself caught fire and was destroyed. One can well imagine that the two men assigned to work one of these engines had a hot task and one that was likely to become extremely dangerous at any moment. At the time of the Great Fire of London in 1666, the city had several of these engines but they were almost all burnt out at an early stage of the fire. The struggle was thus left entirely to squirts and buckets which were of no more avail than children's toys against a



A good example of the early hand-pump fire engines

conflagration of such fearful intensity.

The Great Fire of London began in Pudding Lane in a wooden house said to have been occupied by the King's baker. Fanned by a strong east wind the flames quickly spread to the adjoining property and in a very short time the outbreak was quite out of hand and rapidly assumed terrifying proportions. Throughout that day the panic-stricken dwellers in houses in the path of the advancing flames were removing their belongings with frantic haste, realising that their homes were doomed. The spectacle was frightful enough during daylight but when darkness fell it became appalling, the sky for miles around being of an angry blood red hue. While the main conflagration pursued its raging course sparks and small fragments of blazing timber were carried far and wide by the strong wind with the result that small outbreaks of fire occurred in all sorts of unexpected places so that no one knew whether his house would survive or not. The only really useful service performed by the hand squirts was in extinguishing these minor conflagrations.

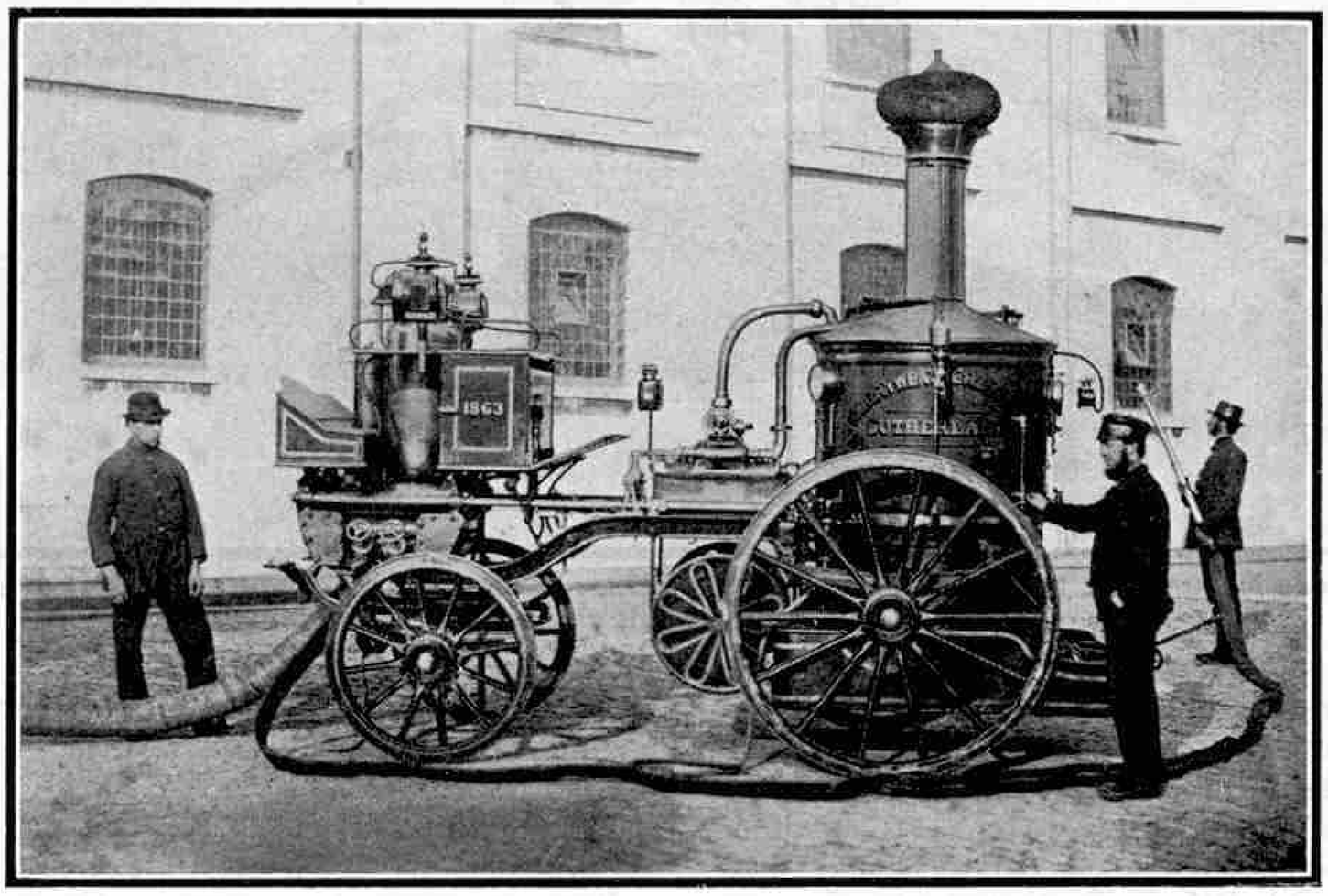
In the main line of fire the heavily timbered houses and shops were eaten up by the flames with almost incredible rapidity, and throughout that night and the following day and night the unabated wind drove the fire steadily forward. Pepys, the famous diarist, in the course of his graphic notes on the fire tells us that the advance of the flames was so rapid that in many instances people who had hurriedly transferred their property to a quarter that seemed perfectly safe had to make a second move within a few hours. The streets were packed with homeless people carrying their belongings on their backs or trundling them on hastily requisitioned handcarts. It was a scene of wild panic, men, women and children fighting their way onward in a desperate effort to reach some place where they would be safe from the fire.

During the second day almost every hour recorded the destruction of some important building in the city. St. Paul's Church, the Guild Hall, the Royal Exchange and the Custom House, were overtaken one by one and completely gutted. On the third day the wind abated and the progress of the fire was checked. On the following day it seemed to have burnt itself out but in the evening flames burst forth once more at the Temple. The authorities blew up with gunpowder the surrounding houses in the endeavour to prevent a further spread. In this they were successful and the outbreak was subdued.

It now became possible to take stock of the fearful havoc that had been wrought. During its three days' supremacy the Great Fire covered an area of 436 acres, extending from the Tower to Temple Church, and from the North East gate of the city to Holborn Bridge. Three of the city gates, four stone bridges and several prisons were destroyed, while the buildings in 400 streets and lanes were gutted. It was estimated that 13,200 houses were destroyed, while in addition to St. Paul's Church and the other notable buildings already mentioned, 86 parish churches, six chapels and numerous hospitals and public libraries were burned out. It is remarkable that only six persons were killed in such a colossal disaster. The total loss of property was estimated at the time to be £10,730,500.

This costly fire roused the Government to the need of establishing some reliable system of fire prevention and several Acts relative to this were passed during 1666 and the following year. One of the Acts of 1667 stipulated that "for preventing and suppressing of fires for the future the city of London shall be divided into four districts and each thereof shall be provided with 800 leather buckets, 50 ladders of different sizes, from 12 to 42 ft. in length, three brazen hand squirts to each parish, 24 bucket sledges, and 40 shod shovels." Each company was ordered to provide itself with "an engine, 30 buckets, three ladders, six bucket sledges, and two squirts, to be ready upon all occasions." For effectually supplying the engines and squirts with water, pumps were to be placed "in all the wells, and fireplugs in the several main pipes belonging to the New River and Thames waterworks." This may be said to have marked the beginning of organised fire-fighting on a large scale.

The production of an efficient fire extinguishing machine occupied the attention of many inventors in various countries. One of the greatest problems to be solved was that of producing a really reliable flexible hose that would render it unnecessary to draw a fire engine close up to the fire before it could be brought into operation. The common form of hose in use up to the latter part of the 17th century was made of canvas coated with paint to render it watertight. This was fairly satisfactory for a short time but it quickly became so leaky as to be practically useless. In 1672 two Dutchmen named Van der Heide, who were inspectors of fire extinguishing apparatus at Amsterdam, solved the problem by making a hose of flexible leather. This hose was sewn together at the seams and was made in 50 ft. lengths each fitted with brass screws at the ends so as to enable any number of lengths to be joined together quickly and securely. This hose was introduced for the first time on a manual fire engine constructed by the two Dutchmen in the same year and it was given a thorough test at a fire that occurred in Amsterdam in 1673. The result was so satisfactory that the inventors were granted the exclusive manufacturing rights for a period of 25 years.



A forerunner of the modern horse-drawn steam fire engine

Richard Newsham, a pearl button maker of London, obtained a patent in 1721 for "A new water engine for the quenching and extinguishing of fiers." The chief feature of this engine was an arrangement of segments and chains for working the pistons. Four years later Newsham patented a second manual fire engine and this was adopted by many towns in this country. The patent specification stated that the engine required "a set of men to work at the levers as usual and a second set who stood on the engine above the levers, holding on to a handrail and stepping off and on to the treadles or footpieces as each lever was raised or depressed; their weight, in addition to the strength of the pumpers at the levers, giving the engine great power." Newsham manufactured his engine in six different sizes, of which the fifth appears to have been very popular. This size of engine was capable of throwing 160 gallons of water per minute to a height of 165 ft.

Some quaint remarks upon the operation of these manual fire engines were included in a book written in 1734 by a man named Switzer. "Richard Newsham of Cloth Fair, London, engineer, makes a most useful, substantial and convenient engine for quenching fires, which carries continual streams with great force," writes Switzer. "He hath applied several of them before His Majesty and the nobility at St. James' with so general an approbation that the largest was at the same time ordered for the use of that royal palace. The largest engine will go through a passage about three feet wide in complete working order, without taking off or putting on anything, and may be worked with ten men in the said passage. One man can quickly and with ease move the largest size about in the compass it stands in, and is to be play'd without rocking upon any uneven ground with hands and feet, or hands only, which cannot be paralleled by any other sort whatsoever. There is conveniency for about 20 men to apply their full strength and yet reserve both ends of the cistern clear from encumbrance, that others at the same time may be pouring in water which drains through large copper strainers."

When the steam engine had reached the stage of practical utility, inventors turned their attention to applying steam power to the operation of pumping engines. The first man to construct a successful steam fire engine was a London engineer named John

Braithwaite. In 1828 he built an engine of 10 h.p. having two horizontal cylinders and pumps of 7 in. and 6½ in. diameter respectively, and of 16 in. stroke. Each steam piston and the pump piston were attached to one rod while the waste steam from the cylinders was led through the feed water tank by means of two coiled pipes. By this arrangement the feed water was raised appreciably in temperature before it was pumped into the boiler. The period required to raise sufficient steam to operate the pump was about twenty minutes from the time the fire was first lit. The engine weighed 24 cwt. and was capable of throwing approximately 40 tons of water per hour to a height of 90 ft.

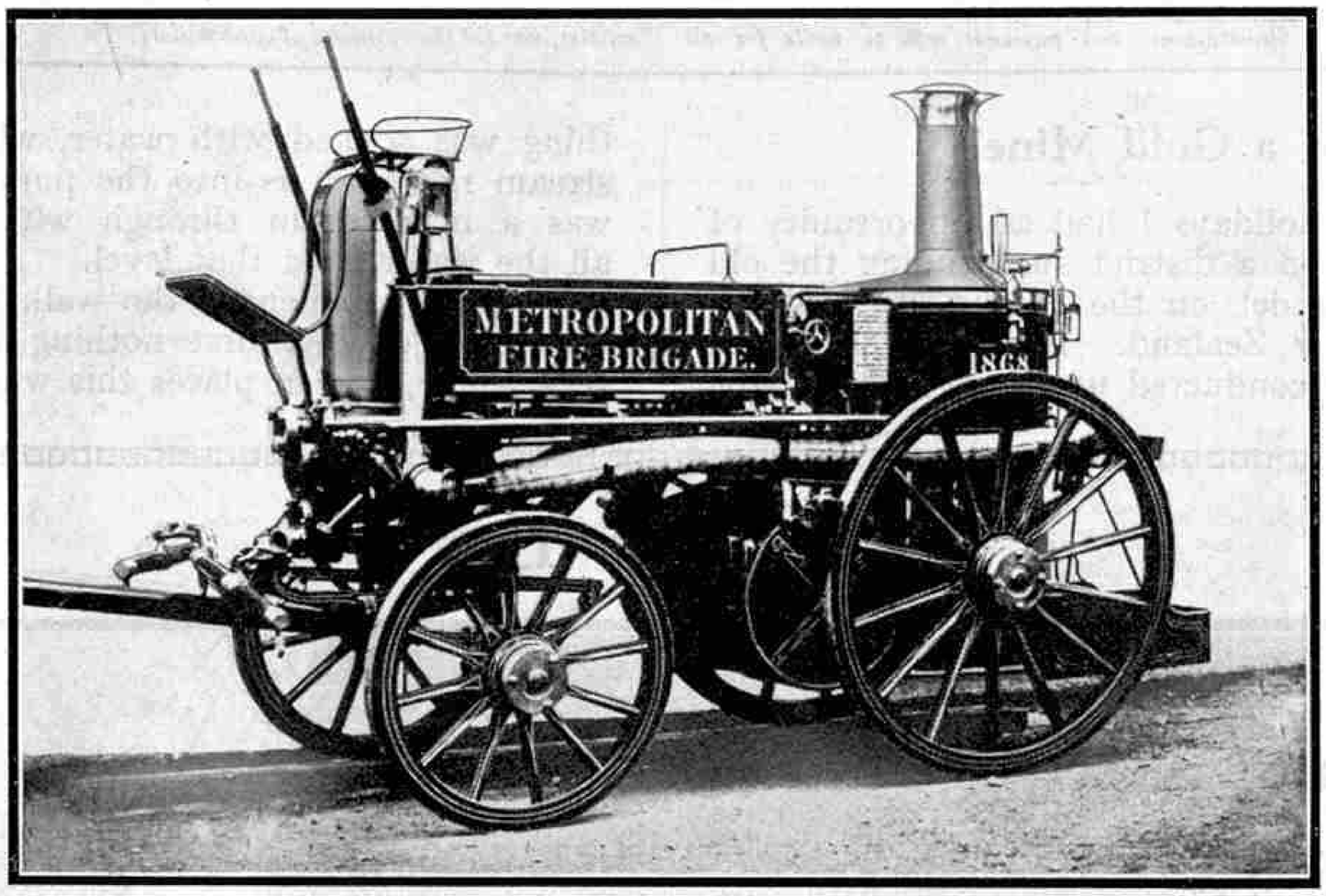
The engine soon had an opportunity of demonstrating what it could do. A fire occurred at the Argyll Rooms during the winter and the cold was so severe that the manual engines that were rushed to the scene quickly became frozen up and useless. The Braithwaite engine, however, pumped continuously for five hours throwing a steady stream of water that reached well up to the dome of the building. Great service was rendered also at a fire at Barclay's Brewery. This led to the engine being lent to the Company for a month during which period it had the unaccustomed task of pumping beer day and night!

Although the steam fire-engine immediately showed that it was far more efficient than the manual engine the public did not take to it by any means kindly. Many skits were made regarding Braithwaite's invention, which was referred to in the papers as a "steam squirt" and as "Braithwaite's kitchen stove." Four more engines of this type were constructed between 1829 and 1832, but they were so unpopular with the general public that no more steam fire engines were built in this country during the next twenty years.

An interesting manual engine was constructed for the London and Birmingham Railway in 1842 by Mr. Merryweather the founder of the famous firm that bears his name. This engine was the largest hand-pumping engine that had been constructed in this country up to that time. The engine was mounted on railway wheels so that it could travel to any point required on the company's line. Spring buffers at each end of the engine were so arranged that they could be dropped down out of the way of the levers when the engine was in operation. The engine had a capacity of 450 gallons of water accommodated in a cistern 13 ft. in length, and it carried two gun metal pumps each 9 in. in diameter by 10 in. stroke. A leather hose 400 ft. in length was carried on a large reel mounted at the forepart of the engine. The engine was worked by 42 men, and when a single 1¼" nozzle was used it proved capable of throwing a steady stream of water to a height of more than 100 ft. Even greater heights were obtained by the employment of a nozzle of slightly smaller diameter.

The steam fire engine was re-introduced into this country by Shand Mason and Company. These engines had cylinders of 8½" diameter by 6" stroke, and worked up a speed of more than 200 strokes per minute. In the course of a trial at Waterloo Bridge one of them, fitted with a ⅞" diameter nozzle, succeeded in throwing a stream of water to a height of about 140 ft.

The first steam fire engine built by Merryweather & Son was constructed in 1861 and was named the "*Deluge.*" It was fitted with a single horizontal cylinder 9 in. in dia. by 15 in. stroke, and had a double acting horizontal pump 16½ in. in dia. by 15 in. stroke worked direct on the piston rod of the engine cylinder. This arrangement obviated the use of a fly wheel, crank shaft, etc. The engine was of 30 h.p. and in actual practice, when fitted with a nozzle 1½ in. in diameter, threw a stream of water over a chimney 140 ft. in height. The following year the firm of Merryweather built their second steam fire engine and gave it the name of the "*Torrent.*"



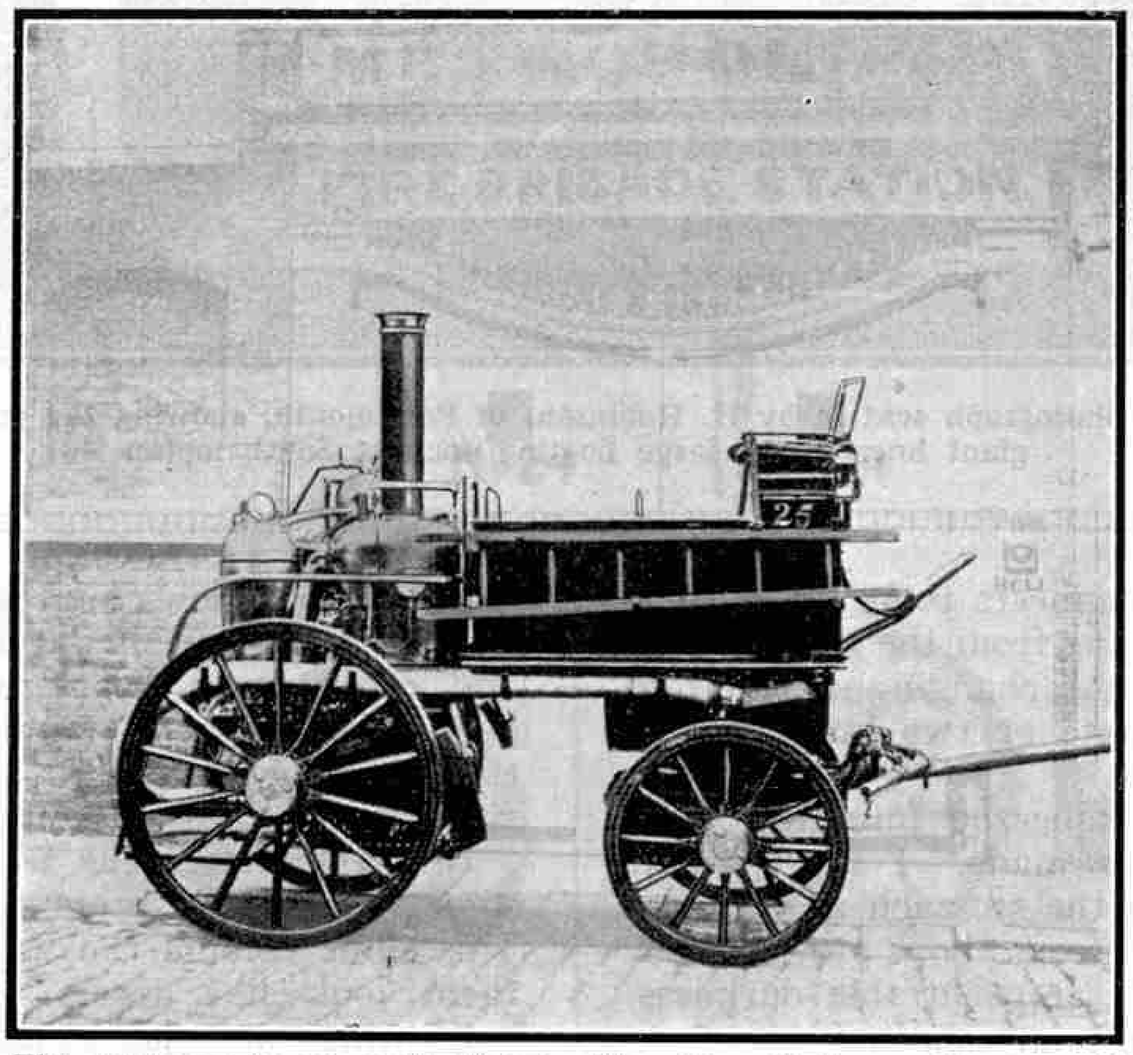
An engine used by the London Metropolitan Fire Brigade in 1868

The superiority of the steam fire engine gradually became realised by the public, and horse-drawn steam pumping engines soon began to take the place of hand-drawn manual engines. The first steam fire engines were quite small and were drawn by a single horse, but it was not long before engines of greater size and power with shaft accommodation for two or three horses were built for use in London and other large towns. High speed motor driven vehicles have now replaced the horse-drawn engines. These motor engines do not present the thrilling sight of one of the old engines, dashing along at full speed, drawn by three powerful horses, but they are of much greater efficiency and are also more economical.

The development of the all-important quality of speed in fire engines has been accompanied by a corresponding increase in pumping power. The latest types of motor engines are equipped with turbine pumps capable of lifting water from a depth of 16 ft. in as many seconds, and of delivering it through extensive lengths of hose at the rate of 600 gallons per minute at a pressure of 100 lb. per sq. in.

The duty of a fire brigade is not only to extinguish fires but also to rescue people who may be trapped in burning buildings. This part of the fire-fighter's task has become increasingly difficult with the growth in the height of buildings, and the urgent necessity of being able to reach quickly the upper storeys has resulted in the development of mechanically-operated fire escapes capable of rapid extension to a height of 80 ft. or more.

Next month we shall describe the mechanism and equipment of a large modern fire-fighting machine, such as is used in large towns throughout the world.



The entrance to an early Metropolitan Fire Station, with a small horse-drawn engine in front

FROM OUR READERS

Contributions not exceeding 500 words are invited, with or without photographs or sketches for use as illustrations, and payment will be made for all articles published. The Editor takes no responsibility for the accuracy of statements contained in such articles, nor for the opinions of contributors.

Down a Gold Mine

During the school holidays I had an opportunity of visiting a gold mine in a district surrounding the old gold town of Coromandel, on the Pacific Coast of the North Island of New Zealand. The Chief Engineer took us in hand and conducted us through the engine room, where the pithead engine and the big pump are situated. These machines, as well as a small generating plant for lighting the mine with electricity, obtain steam from a large boiler of the marine type. The pump, which works on the beam principle, is still going strong after 50 years of active service, and is claimed by the engineers to be as efficient as any electric pump. Emerging from the stuffy boiler room, we made our way to the changing-sheds, from which we issued forth a minute or two later clad in the filthiest old miners' "togs."

Arriving at the shaft, we squeezed into the little cage in which the descent is made. I must admit that I had a funny feeling in the stomach as the cage increased speed! As the light from above grew fainter, and finally melted into black, impenetrable darkness, with water splashing from the pump shaft, I was overcome by a sense of helplessness; but I soon recovered from this sensation after we had climbed out at the 400 ft. level.

When the guide had succeeded in lighting a very obstinate piece of candle, we found ourselves in a more or less square chamber, the walls and roof of which were composed of solid rock. Passages branched off in all directions, each one with its tram track. Everything was soaked with water, while quite a fair-sized stream ran past us into the pump well. This stream was a main drain through which flowed practically all the water from that level.

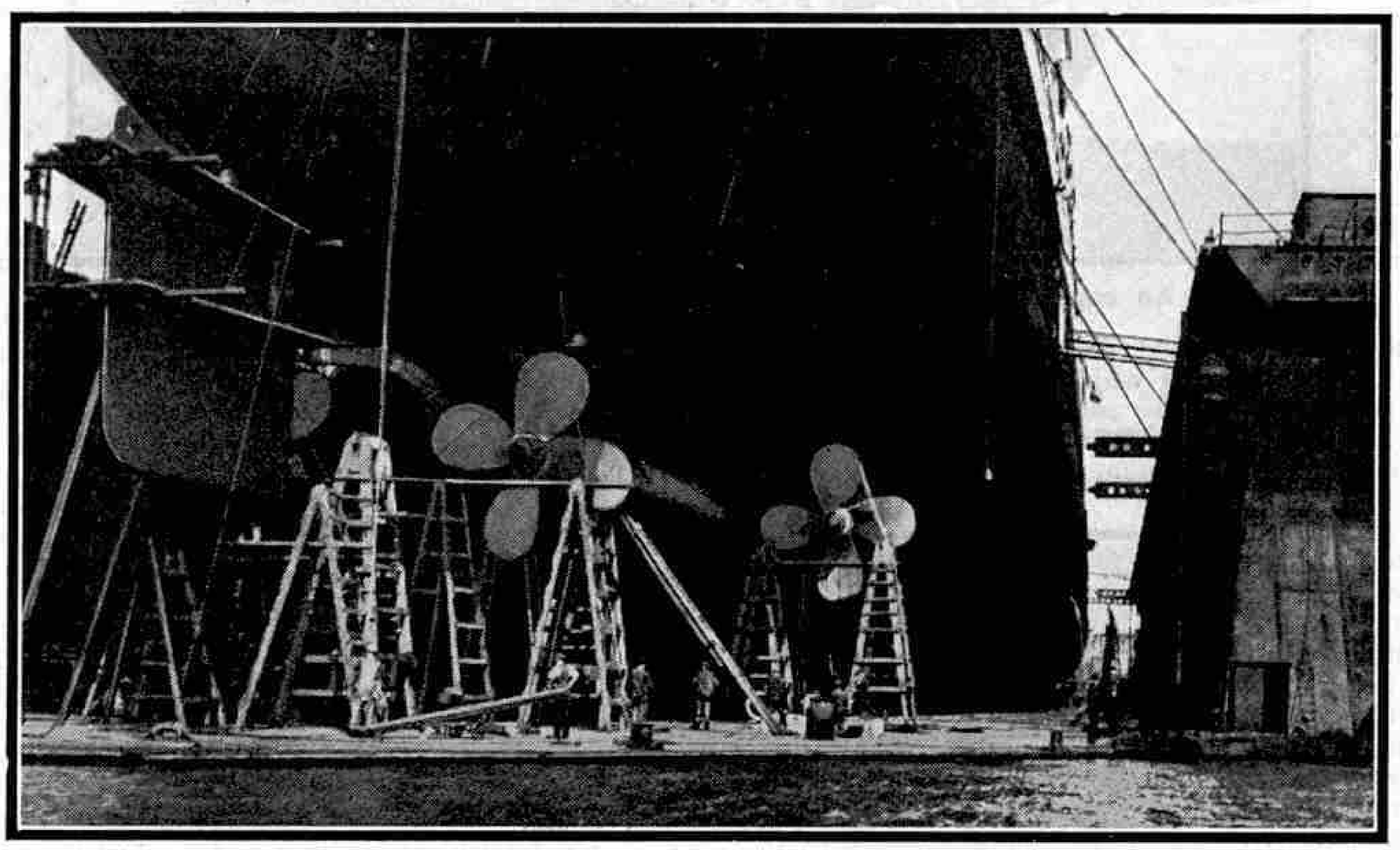
We now commenced the walk through the numberless passages. At first nothing but water and slime was visible, and in places this was so deep that it was necessary to walk on the rails. Presently we came to a new reef on which work had only recently been commenced. The metal-bearing quartz was plainly seen, and we were told that, with the aid of a strong light, the gold itself could be distinguished by the naked eye. There was also plenty of what the miners call "new-chum gold," that is, iron pyrites. This substance is similar to gold in colour and lustre, and was given its expressive name because it has often deceived the eye of mining novices. On our way to the new reef we passed a gang busily engaged in installing pipe lines for compressed air.

In many places the walls were covered with a red slime, due to the presence of a compound of arsenic. This slime colours the water in the drains and makes them look like rivers of blood! Quite frequently hot springs are also struck, and in one corner of the mine a beautiful silica terrace formation is to be seen.

There is so much water in the mine that a visitor is fortunate if he gets through the levels without his candle being extinguished by a drop of water from the roof. One cannot get lost in any worked part of the mine, as the way back to the shaft may easily be found by following the drain water!

MAXWELL GAGE (Auckland, N.Z.).

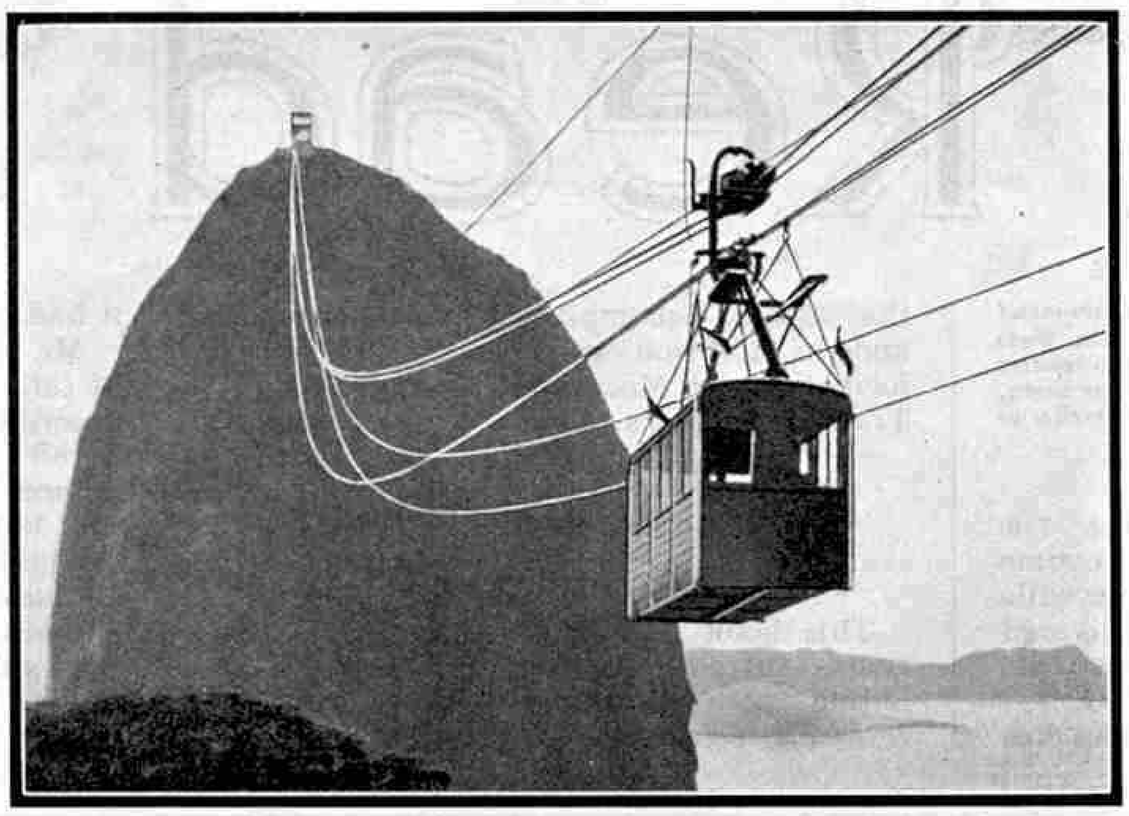
High and Dry!



An interesting photograph sent in by H. Robinson, of Portsmouth, showing the propellers of a giant liner in the large floating dock at Southampton

The Sugar Loaf—Rio de Janeiro

When a traveller inquires if there is anything to see in Rio—the customary contraction for Rio de Janeiro—the Brazilians' list of attractions invariably commences with the "*Sugar Loaf.*" The trip to this mountain is really well worth while, for from the summit one of the most beautiful panoramas in the whole world may be seen. From its position at the end of one of the peninsulas that form the narrow entrance to the harbour, the *Sugar Loaf* completely dominates its surroundings.



The upper line trolley photographed from the lower mountain. The safety lines are clearly shown

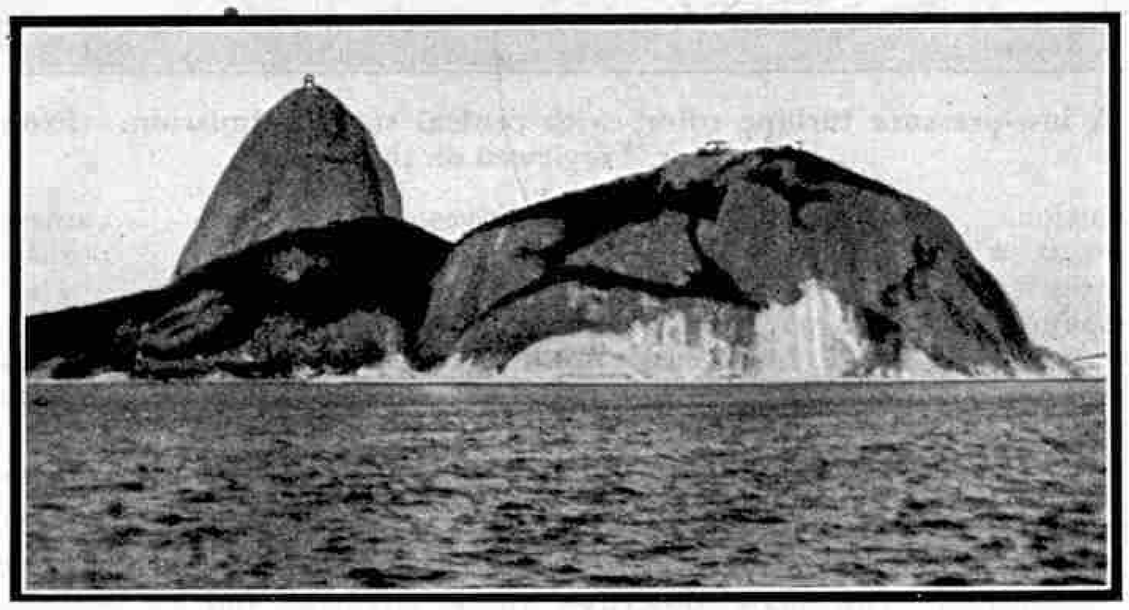
There is some doubt as to who first reached the top of the *Sugar Loaf*, for its sides rise sharply out of the sea and there is no vegetation to give any help to climbers. It is said that the honour belongs to an English sailor who used iron spikes driven one at a time into the hard rock, and who proudly planted the English flag when he reached his goal. I am inclined to believe this, for the spikes are still to be seen implanted in the rock.

Anyone may now ascend the peak by making use of the aerial railway that reaches to its crest. The passenger steps into a car that is suspended from cables, and is carried from sea level to a height of 400 metres in two stages. The first stage ends on a lower hill, where there is a restaurant with other attractions. After walking the whole length of this hill a station is reached from which a second car starts on its upward journey. This second ascent is 800 metres in length and when the terminus is reached the magnificent panorama opens out around. On one side is the blue Atlantic Ocean, and on the other is the great bay surrounded by ranges of high mountains. The view is unique, and at night a perfect horseshoe of light is visible round the shores of the harbour.

In spite of its frail appearance when seen from below, the railway is perfectly safe. In the event of anything happening to the machinery, an automatic apparatus brings into action a powerful brake that enables the car to enter a station at greatly reduced speed. The cables are secured at both ends in huge steel buckets filled with granite and cement and they are able to support a weight of 150 tons each, whereas the cars weigh only five tons when fully loaded.

The aerial journey to the summit of the *Sugar Loaf* is as popular with the residents of Rio as it is among visitors to this picturesque city.

W. E. ALDRIDGE (Rio de Janeiro).



View of the whole Sugar Loaf group as seen from the inside of the Bay of Guanabara

How Hack-Saw Blades are Made

The first step in the making of hack-saw blades consists of melting-up steel of a suitable quality and allowing it to cool in long flat sheets measuring roughly 6 ft. by 2 ft. When the sheets are cooled they are lifted in elevators to a room where cutting is carried out. Here a man cuts off the ends to ensure a smooth edge being given to the blades, and also cuts the strips for the blades in widths ranging from $\frac{1}{4}$ in. to perhaps 2 in. The strips are then placed in metal trays having sides but no ends. In these trays the strips are packed tightly together and passed beneath the blade of a cutting machine, which cuts one row of teeth after another.

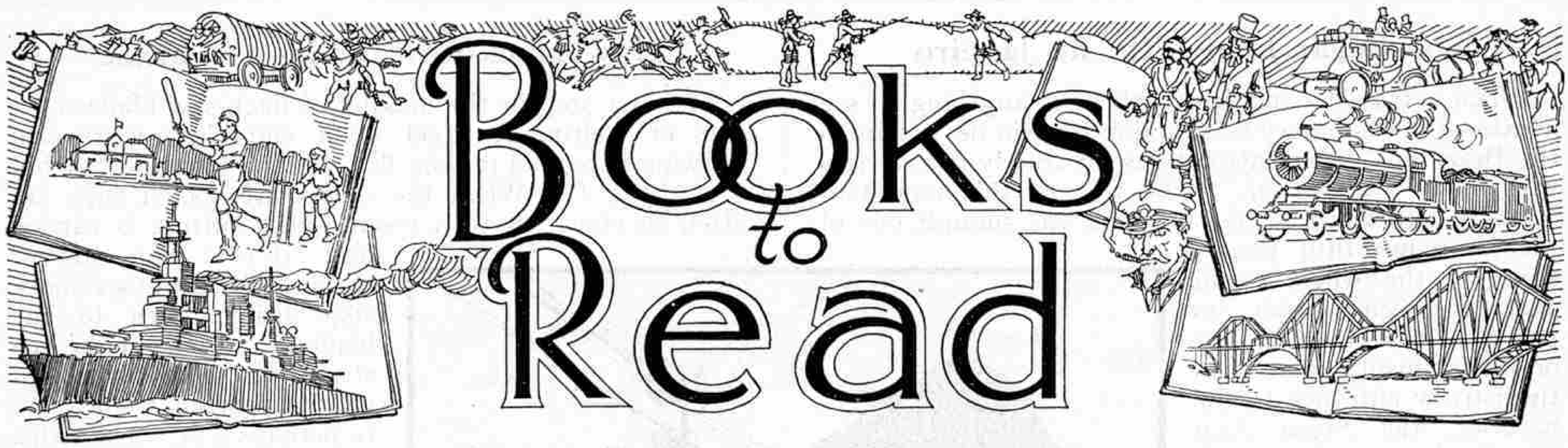
The blades thus formed are twice the length required and have square ends. They are then passed one at a time beneath an interesting machine that cuts the blade in half and makes the cut ends circular, stamps the name of the firm twice on each half and also stamps holes in the ends of the blades. The next step is to pass the blades one after another into a machine that waves the teeth from side to side, which has the effect of making the teeth cut better.

The blades now appear to be finished, but they would be useless for cutting purposes because the steel is soft. They are therefore gathered up from the bin at the back of the waving machine, placed in metal racks and passed into an oven capable of holding about twenty racks at a time. The blades quickly become white hot, and when they have been in the oven for five minutes they are pulled out and plunged into large oil tanks. This process hardens the steel but it does not complete the work, because if the ends of the blades were left hard they would be so brittle that they would break when screwed into the frame. Still another process is necessary.

Just below an endless band two very hot flames are burning, one on each side of the band. Each blade is balanced on the band and carried forward so that the ends pass over the flames at a speed just sufficient to allow the metal to become red hot. The blades then slide down a chute into a bin where they are allowed to cool gradually. The result is the production of a blade with a hard cutting portion but with soft ends.

The final process consists of cleaning the blades by placing them in revolving metal drums that drive off all oil.

A. H. SMITH (Sheffield).



Readers frequently write asking if we can recommend books that are both of interest and of use. On these pages we review books that will specially appeal to readers of the "M.M." We do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

"Engines"

By E. N. DA C. ANDRADE (G. Bell & Sons Ltd. 7/6)

This book, which is founded on a course of six lectures, "adapted to a juvenile auditory" (to use the old phrase), delivered at the Royal Institution last Christmas, will appeal to all readers of the "*M.M.*" In his book Professor Andrade—who has the unusual distinction of being both a poet and a scientist—explains simply and clearly "how it works," the "it" being anything from a 4,000 h.p. Diesel engine to an ice-cream machine.

Linking up the workings of all engines in one general explanation, he clearly shows how Diesels, 12-coupled locomotives and ice-machines all equally obey the same set of laws—the laws by which heat is converted into energy. In a locomotive the furnace is outside and away from the cylinders, but in an internal combustion engine the furnace is placed inside the cylinders. "A gun is really a one-stroke internal combustion engine," says Professor Andrade, "which throws away its piston at each stroke."

It is interesting to learn that the Diesel engine, which is one of the simplest and most brilliant of all modern inventions, was originated by a quiet doctor at a university. As the professor expresses it: "He was not an oil-rag-and-spanner man, but a think-it-out-and-mathematics man; not a bank-it-a-bit-and-see-if-that-helps man, but a physics-say-that-I-must-do-this man," whose engine was a triumph for theory.

The book contains chapters on the rules that all engines must obey; on steam; engines that work to-and-fro; engines that work round and round; putting the furnace in the cylinder; and on how heat engines are made to produce cold. It is well illustrated with diagrams and photographs.

Professor Andrade, both in his lectures and in this book, has admirably succeeded in carrying out the object of the Royal Society, as expressed by Sir William Petty in 1674, when he said: "It is the profession of the Society to make mysterious things plain, to explode and disuse all insignificant and puzzling words, to improve and apply the small threads of mathematics to vast uses." Certainly, the book accomplishes this purpose, and in addition will be a mine of information for Meccano boys and Hornby Train enthusiasts alike.

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"Chronicles of Boulton's Siding"

By A. ROSLING BENNETT (Locomotive Publishing Co. Ltd. 6/6)

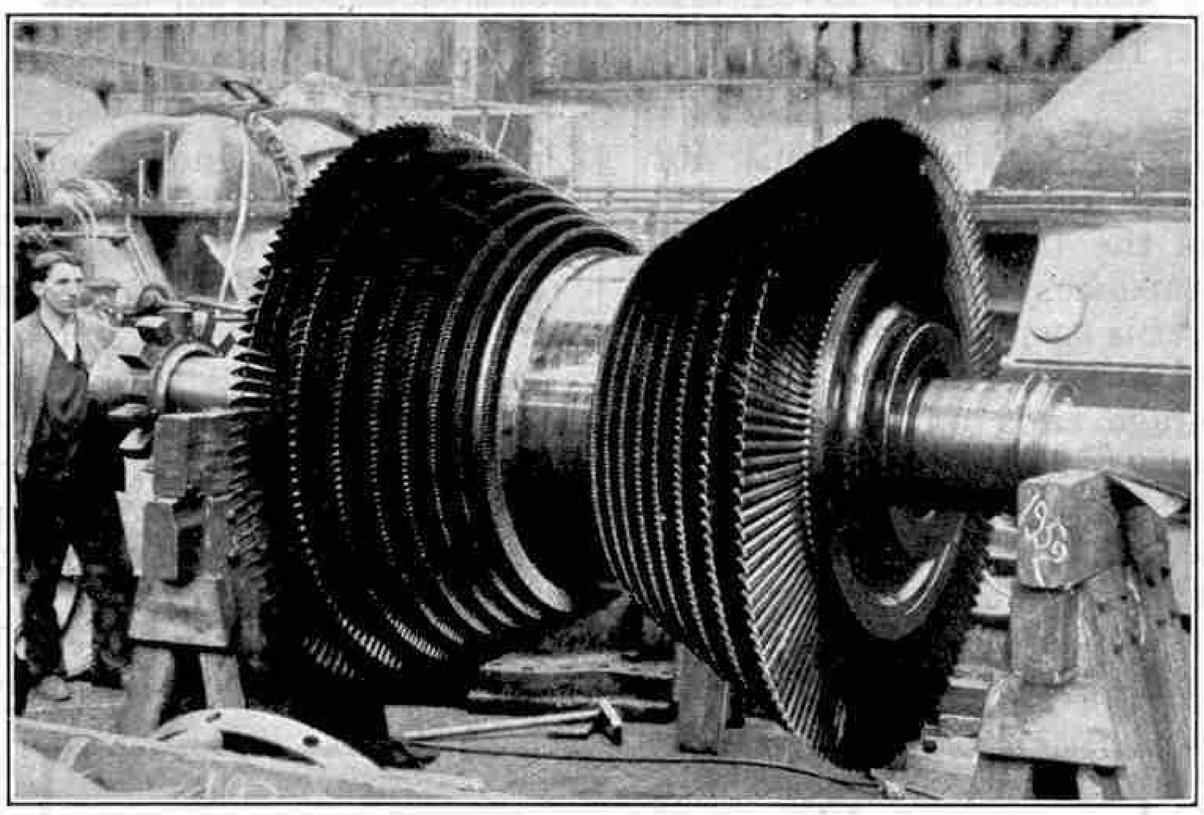
This book (272 pages and 93 illustrations) introduces readers to Boulton's Siding at Ashton-under-Lyne, an interesting centre of activity in the early history of steam locomotives. The greater part of the old works is still in occupation (by the National Gas Engine Company) but so many extensions and additions have been made that but little of the original premises can be identified. The proprietor of the Siding, Mr. I. Watt Boulton, was the moving spirit of the establishment and a very remarkable man, who transformed and created many locomotives during the years 1859 to 1890. The book describes these engines, and history is relieved by many quaint facts and anecdotes, showing the tremendous changes that have taken place in railway operation during the past generation.

In the period dealt with, Boulton's Siding was a by-word with railwaymen who all knew and spoke about it. If anyone referred, however casually, to locomotive history, they would say "Ah! you should go to Ashton and have a peep at Boulton's Siding. It is crammed with historic interest and you'll see things there that are unparalleled." The Siding was so famous, indeed, that it was spoken of familiarly years after it had ceased to exist.

Mr. Boulton had photographs taken of all the locomotives, and some are described in his records in considerable detail. Strange to say, in other instances the reverse is the case, and we are left to conjecture both as to the origin and the characteristics of many engines. We find particulars of many engines of weird and wonderful design, with all kinds of boilers. A mere glance at the illustrations shows us a great deal of the past and depicts clearly the marvellous collection that passed, on its way to oblivion, through Boulton's Siding. Mr. Bennett writes as a real lover of locomotive history, and with an intimate knowledge of engines, in an easy conversational style. Writing of one of Boulton's "transformations," he says: "A committee of Royal Academicians might not have unanimously approved of the design of the tank, perhaps, but it is understood to have been improvised in a hurry. It rather looks as if practical Mr. I. W. Boulton had remorselessly confiscated the domestic cistern in his anxiety to fill the order."

The substance of the volume appeared originally as a series of articles in "*The Locomotive*" between November, 1920, and February, 1925. During the publication of these articles many new facts came to light, and have now been incorporated into the present volume.

The book is full of interest to the railway enthusiast, and appealing particularly, of course, to the student of historical locomotives.



A low-pressure turbine rotor, with central steam admission. (From "*Engines*," reviewed on this page)

* * * *

"Yarns from a Windjammer"

By MANNIN CRANE (Heath Cranton. 7/6)

We are rather apt to look upon the sailor as being a man apart, and we forget that the sea claims the lives of 60 seamen every day of the year in order that we may have supplies of the necessities of life. Not only does the author, well known for his writings on marine matters, vividly sketch the daily life of the sailor and tell us of the troubles and dangers that he encounters, but he also makes us see that the ship itself is a creature of moods—a coquette or a vampire at will.

All those who like tales of the sea will find an irresistible desire to pause over some of these well-told tales—to live again with the fine sailormen and to join in their roaring shanties when homeward bound.

"Policing the Top of the World"

By H. P. Lee (John Lane, The Bodley Head Ltd. 8/6)

Shortly after the War the Canadian Government decided to enforce its jurisdiction over the vast area of land lying to the north of the Arctic Circle, and naturally it handed over that duty to the force that had already carried out such magnificent work in the North-West Territories—the Mounted Police. Mr. H. P. Lee, then a private in the Mounted Police, formed one of the tiny detachment that sailed north from Quebec in July, 1922, and in this book he describes for us the two thrilling years spent in Ellesmere Land, within 400 miles of the North Pole.

Most of us have read many books on Arctic exploration and have been thrilled by the magnificent courage and endurance of the men who fought their way onward towards the Pole. Mr. Lee's book is just as thrilling but in an utterly different manner. He describes in detail what one might term the domestic life of this lonely police detachment during their two years' exile, and in doing so he places before us a picture of life in the Arctic such as probably no other writer has surpassed. The word pictures drawn by the author are so clear-cut and sharp in outline that the interest never fails, whether the theme be the hunting of seals, walrus and bears; the terrible hardships of long journeys through raging blizzards, or the utter desolation of the long Arctic winter.

Mr. Lee and his companions certainly were not favoured with good luck. The hut that was their home was burned out completely, with the result that they lost most of their belongings, and practically everything in the way of comfort that they possessed. As if this were not sufficient, they shortly afterwards had a very narrow escape from death by gas poisoning. Mr. Lee describes these occurrences in a quiet, matter-of-fact manner that is impressive in its very simplicity, and he gives us a wonderful insight into the mentality of the men who met these misfortunes quietly and calmly, and even succeeded in extracting a spice of humour from the most desperate episodes.

It is not easy for us to enter into the life and viewpoint of the Eskimo, but certainly no one can read this book without feeling that in some indescribable manner he has drawn a little nearer to these strange people. The daily life of the Eskimo family that accompanied the police detachment is placed before us in detail, and as the book proceeds we feel that we are becoming personally acquainted with Kakto and his wife Oo-Lar-Loo and their children. Perhaps the most impressive chapter in the story is that which tells of the death of Bunny, Kakto's five-year-old daughter, and of the baby Kownoon, and how they were laid to rest in their little grave in the frozen north to the accompaniment of the wild wailing of Oo-Lar-Loo.

A particularly interesting incident is the meeting with Etukashuk, the Eskimo who accompanied the notorious Dr. Cook on his alleged journey to the Pole. Mr. Lee places quite a new aspect upon this remarkable impostor. He asserts confidently that Cook's journey was a really remarkable exploit, and that if the explorer had been content to tell the truth about it he would have held a high place among modern Arctic travellers. Unfortunately Cook did not do so, and his disastrous exposure is still fresh in our memories.

The secret of the success of Mr. Lee's narrative most probably lies, not in his literary ability—although this is considerable—but in the boyish enthusiasm with which he writes. He carries one along with him, and one cannot help feeling something of the wild excitement of the little party when the relief ship is sighted and the two long years of exile are over.



The Royal Canadian Mounted Police detachment at Craig Harbour, Ellesmere Land, outside their quarters. (From "*Policing the Top of the World*," reviewed on this page)



The Royal Canadian Mounted Police Post at Craig Harbour, Ellesmere Land, after being newly painted by the men (see above)

* * * *

"A Great Sea Mystery"

By J. S. Lockhart (Phillip Allen. 6/-)

This book deals with the great mystery of the "*Marie Celeste*," details of which were given in the "*M.M.*" for March 1927. Much has been written about this famous ship, which was found derelict in mid-ocean without a soul on board and without any clue as to why she had been abandoned. From time to time various solutions to the problem have appeared, compiled, it has been claimed, from some survivor's or eye-witness's narrative. As Mr. Lockhart shows in the present book, all such solutions are falacious, however, and the mystery has remained to puzzle and to fascinate, losing none of its attraction with the passage of years.

In this book the facts taken from official and authoritative documents are given in full, and the various explanations that have been put forward from time to time are examined and reviewed in their turn. Finally Mr. Lockhart from information obtained from unquestionable sources, sets out what seems undoubtedly to be the genuine solution of this, the greatest of all mysteries of the sea.

It would be unfair to disclose the answer to the problem but the book is one that is well worth reading—especially by anyone who has a desire to become a detective!

* * * *

"A Book of Nonsense"

(J. M. Dent & Sons Ltd. 2/-)

This book takes, as its foundation, the wonderful nonsense rhymes and sketches of Edward Lear, which have delighted both old and young for three generations. Many of our old favourites are included, as for instance:

"There was an Old Man who said, "How—
Shall I flee from this horrible Cow?
I will sit on this stile,
And continue to smile,
Which may soften the heart of that Cow!"

These are followed by several of the famous verses, none of which seem to lose any of their freshness and charm with the passage of years—"A Frog He Would A-Wooing Go," for example. There is a fairy tale ("King Nut-Cracker"), for children told in verse, being a free translation from the German, and Nonsense Rhymes from Lewis Carroll's "*Alice in Wonderland*." We are made to laugh again over such jolly nonsense as: "How doth the little crocodile improve his shining tail," and "Will you walk a little faster, said a whiting to a snail." There are two or three short stories in prose, and a collection of Nonsense Rhymes from "Mother Goose's Melody" and other great works.

This handy little book (238 pages) will afford many an hour of enjoyment to its lucky possessor.

Interesting New Books

We hope to deal with the undermentioned books in an early issue.

"The Wireless Manual"
by Capt. Jack Frost (Pitman), 5/-

"Remarkable Machinery"
by Ellison Hawks (Harrap), 7/6

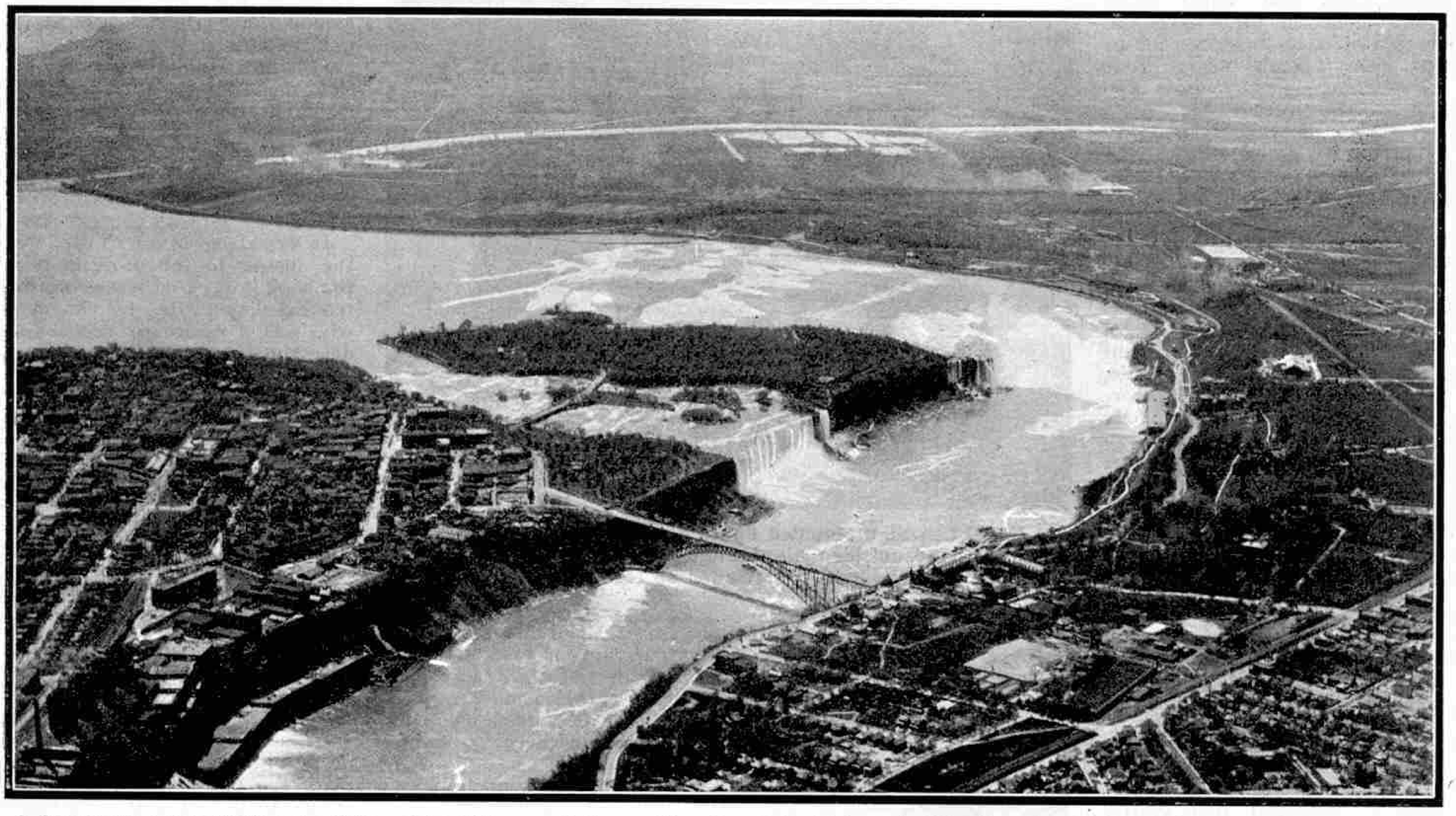
"Shell Life"
by Edward Step (Warne), 7/6

"Book of Polar Exploration"
by E. L. Elias (Harrap), 7/6

"Recreation Series. Ju-jitsu and Judo," "Rugby Football," "Boxing," "Association Football," "Hockey," "Stamp Collecting" (Fredk. Warne), 6d. each.

Niagara Falls Committing Suicide!

How They May Be Restored To Their Former Glory

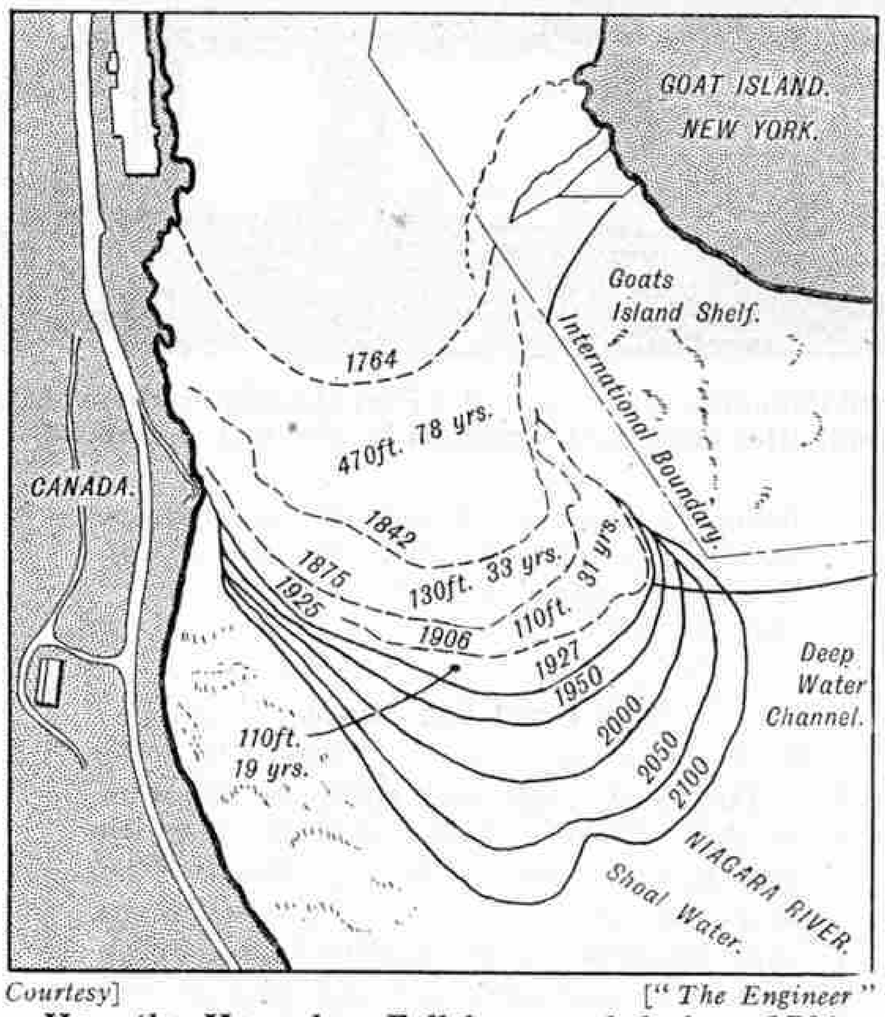


A fine aerial view of Niagara Falls. The difference between the almost straight crest of the American Fall and the curve of the Horseshoe Fall beyond it, and the lack of water on the shelf on the Canadian side of Goat Island, are clearly shown

THE first definitely authenticated visit of a European to the Niagara Falls was made about 250 years ago. The Falls had been mentioned earlier by Cartier and Champlain, the famous Frenchmen who founded the French Colony in Canada, but so far as is known Father Hennepin, a Jesuit missionary, was the first of the colonists to describe the wonderful scene as an eye witness. When travelling in the vicinity he heard the "Thunder of Waters," as the Indians called it, while still many miles distant, and on reaching the Falls he was so astounded at their magnificence that he described the waterfalls of Europe as sorry patterns in comparison.

Hennepin speaks of two great falls divided by an island. These were, of course, the now well-known American and Canadian Falls, the former, 1,060 ft. in width and 162 ft. in height, being separated by Goat Island from the Canadian Falls, which are almost three times as wide and only 7 ft. less in height. Goat Island itself presents a frontage of 1,300 ft.

But a sketch made by the discoverer shows three falls, the additional one being beyond the Canadian Fall and separated from it by a large rock. The third fall and the rock were mentioned by another early traveller, who was informed that they had disappeared a few years before his visit. Since then other large masses of rock have fallen at various times, culminating in 1850 in the break away of a shelf on the Canadian side known as Table Rock. The fall of these large masses naturally attracted attention, and further interest has been aroused in the subject since the establishment of large power stations has had the result of diminishing the flow of water. As a spectacle the Falls appear to have suffered considerably from this diminution, and fears have been expressed that in time their grandeur and impressiveness would



Courtesy] ["The Engineer"

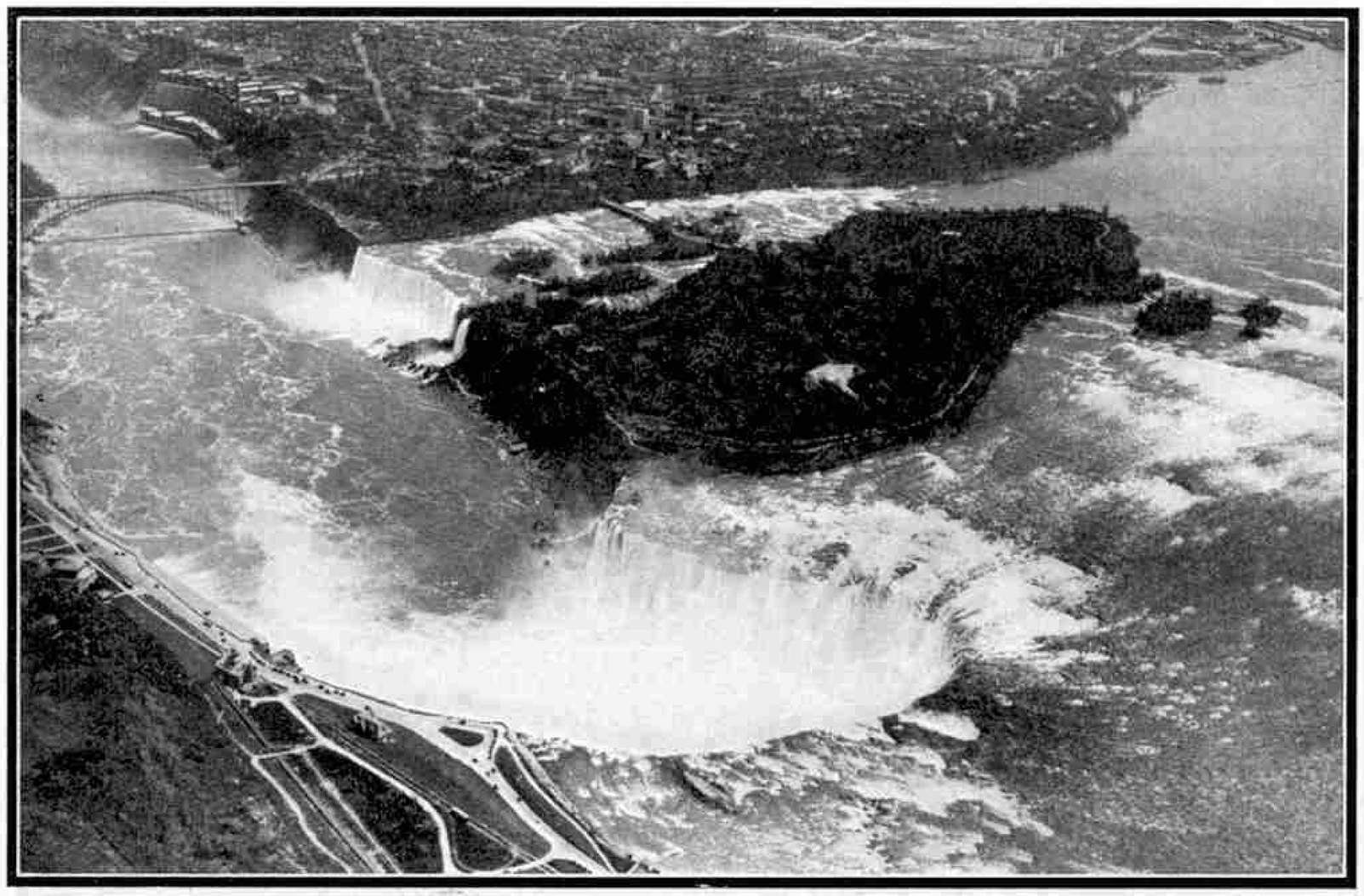
How the Horseshoe Fall has receded since 1764

be destroyed by the abstraction of water, in conjunction with the recession of the brink from natural causes.

The Falls owe their existence to the presence of a ledge of hard limestone resting on a bed of soft shale that extends beyond it. The overflow from Lake Erie forming the River Niagara has cut deep chasms and gorges in the shale, but has been unable to make any impression upon the limestone, with the result that its waters now leap down from a ledge of limestone into the gorges beyond.

But as the water falls it undermines the soft shale supporting the ledge over which it leaps, and as this support is removed large masses of the ledge are broken off by their own weight. Thus the brink of the Falls moves slowly backward, and this backward movement has been in progress for thousands of years. It has been suggested, in fact, that the retreat has brought the Falls to their present position from the end of the gorge at Lewiston, seven miles nearer the shore of Lake Ontario, and their age has been estimated at 32,000 years by comparing the present rate of retreat with the distance thus traversed.

That the undermining of the hard limestone is the correct explanation of the retreat is proved by the fact that the crest of the American Fall has retreated much more slowly than that of the Canadian Fall since the two were discovered, and is now practically stationary. At the foot of the American Fall is a large pile of limestone rocks that have fallen from the shelf. These are too large to be carried away by the flood, and as they intervene between the descending water and the face of the underlying shale they serve to protect the shale from erosion. No such protecting mass of debris exists on the Canadian side, and the shale there is fully exposed to the eroding action of the falling water. It is evident, therefore, that the brink is only receding where the underlying shale is being eroded and the great ledge is being deprived of its support.



Niagara Falls from the Canadian side. This photograph shows how the rush of water is largely concentrated in the notch of the Horseshoe Fall

The amount of recession of the brink of the Canadian Fall has been very serious indeed. It has been truly said that the Mississippi River down which journeyed in 1682 the French explorer La Salle—the first white man to make this voyage—is no longer in existence, as the present course of the river through the great alluvial plains is in many cases several miles distant from the channel that La Salle's canoes followed. Similarly it may be said that the Canadian Fall discovered by Father Hennepin has been replaced by a fall nearly 1,000 ft. nearer Lake Erie.

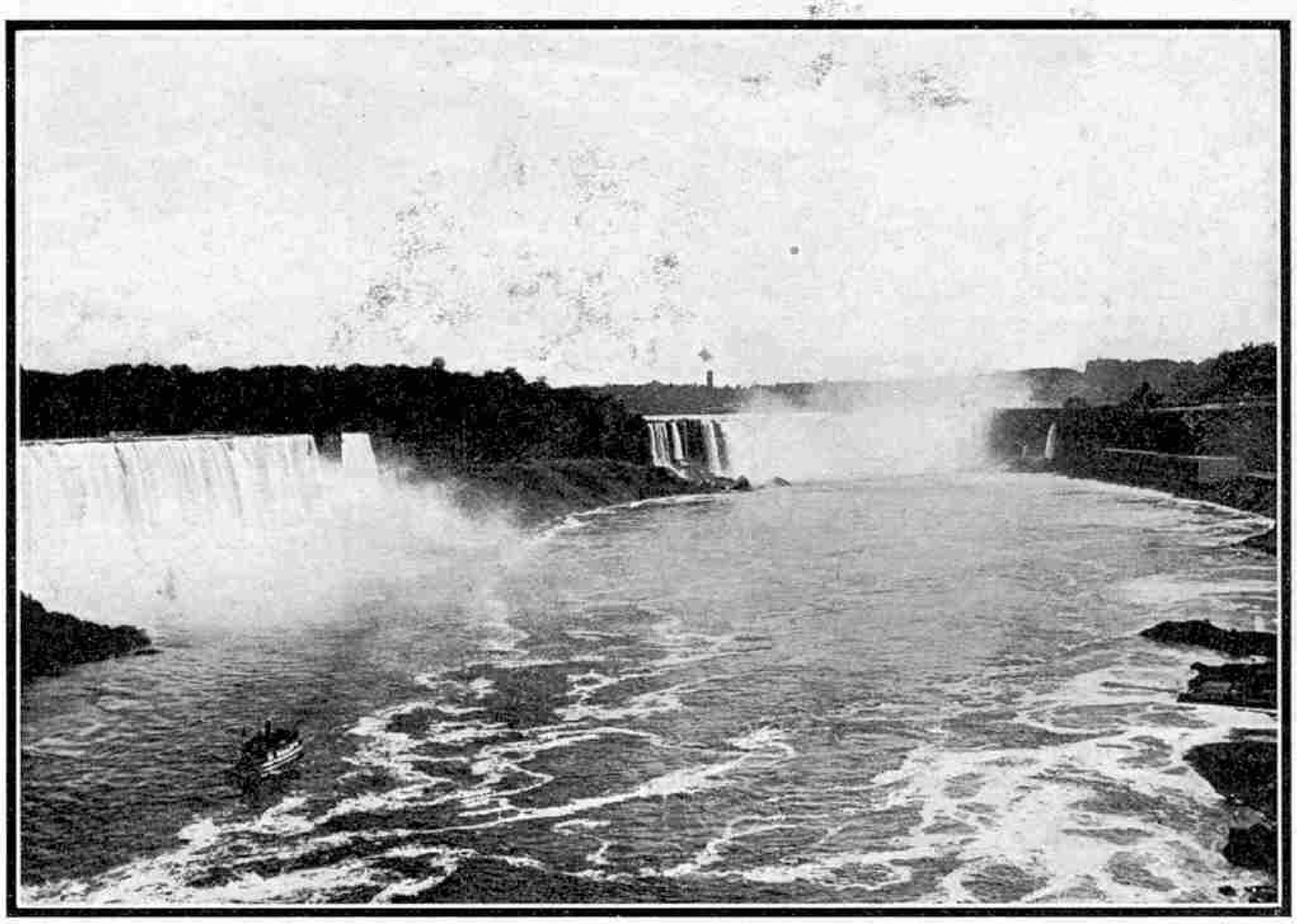
Various authorities have fixed the average rate of recession due to the erosion of the underlying shale at 4.2 ft., 5 ft. and even as much as 7 ft. per annum. The highest of these estimates is probably too pessimistic, but the rate has certainly been sufficiently rapid to arouse fears that the Fall was in a sense committing suicide. From a spectacular point of view it has certainly suffered severely. Some 200 years ago the wall of water extended from Goat Island to the Canadian Shore in a beautifully regular curve that was the origin of the name Horseshoe Fall. Since then erosion has been most rapid in the centre of the curve, where two



A miniature Niagara ! This view of the scale model referred to in the article illustrates a possible method of restoring the full effect of the Horseshoe Fall by placing artificial islands above the crest

deep channels in the river converge, with the result that a jagged and unsightly notch has been cut in the curved outline.

The retreat of the central portions of the ledge has made matters worse in two directions. The currents have become concentrated in the notch and have hastened the process of erosion there, while at the same time the shelves at the sides have been drained of water. Their further erosion has thus been almost entirely prevented, and so they remain, unsightly walls of rock projecting far in advance of the main Fall, and down which only a few thin streams of water trickle.



The American and Horseshoe Falls at Niagara, showing the rapids and the famous steamer *"Maid of the Mist"*

Other causes have assisted in promoting the decay of the Falls, and of these the abstraction of water for power purposes is perhaps the most important. Of the 200,000 cu. ft. of water that flow from Lake Erie every second, no less than 56,000 cu. ft. are taken to the penstocks of the power houses and never reach the Falls. This has not only assisted in spoiling the Canadian Fall, but also has thinned out the American Fall considerably. The maximum quantity of water that may be removed for power purposes without injury to the Falls, as a spectacle, was reported by commissions specially appointed to examine the question to be 64,000 cu. ft. per second, but practical experience over many years has shown conclusively that this amount is far too great unless steps are taken to remedy the effect of the diversion.

The shortage of water is also partly due to operations at Chicago, at the southern end of Lake Michigan, nearly 1,000 miles farther up the Great Lake system. Very large quantities of water have been diverted from Lake Michigan into the River Chicago to wash away sewage, and as that river discharges into the Mississippi Basin, water that should flow over Niagara Falls is finding its way into the Gulf of Mexico 1,000 miles to the south. In addition water is being taken from the Great Lakes for several canals, while in recent years the general level of water in them has been very low for reasons at present uncertain.

Thus a two-fold cause appears to have been at work for years, marring the beauty of the Horseshoe Fall in particular. Unequal erosion has cut a deep notch in the brink of the Fall, and the concentration of the flow of water in the notch, aided by the diminution in the supply, has speeded up the process.

The serious nature of the problem is now fully appreciated and the whole subject has been thoroughly examined by representatives of the Canadian and the United States Governments, in the hope of discovering means whereby the Falls may be preserved. The conclusions that have followed from the examination are happily reassuring. Since 1906 the annual rate of recession at the centre part of the Horseshoe Fall has been only 2.3 ft., and the direction has been up a deep channel on the Canadian side and not in the notch itself, where erosion has been practically non-existent. It seems that the effect of the cutting back that took place in the notch has been to separate the two currents that formerly united on its brink. Thus the area of erosion has been spread out, an effect that is expected to continue. The toe of the Horseshoe is growing broader and, as the Fall moves upstream, will continue to do so for many hundreds of years. Changes in appearance will thus take place slowly.

According to present indications the curve of the Horseshoe Fall will be well defined and regular for most of the remaining part of the present century, but it will be much narrower and deeper than the curve that gave the Fall its name many years ago.

In the meantime the problem of the shelves at the sides of the Fall still remains. The reduction in the volume of water has left the shelf at Goat Island and a part of the flank near the Canadian side practically bare, thus diminishing considerably the width of the Fall. Formerly sufficient water flowed over these two shelves to make one harmonious picture, whereas to-day the chief mass of falling water is in the centre and the sides present a distinctly meagre appearance. Consideration of this part of the problem was perhaps the most interesting feature of the work of the experts appointed by the two Governments.

In order to test the various suggestions for refurnishing the two shelves with water, a large scale "working model" of the Niagara River and Falls was constructed in a field on the American side by one of the power companies closely concerned. The vertical scale is exaggerated in comparison with the horizontal one, but in other respects the model is a faithful reproduction of the present conditions of the two Falls. Matters are arranged so that submerged weirs and artificial islands may be placed in the streams in order to study their effect on the flow of water and on the actual appearance of the Falls themselves.

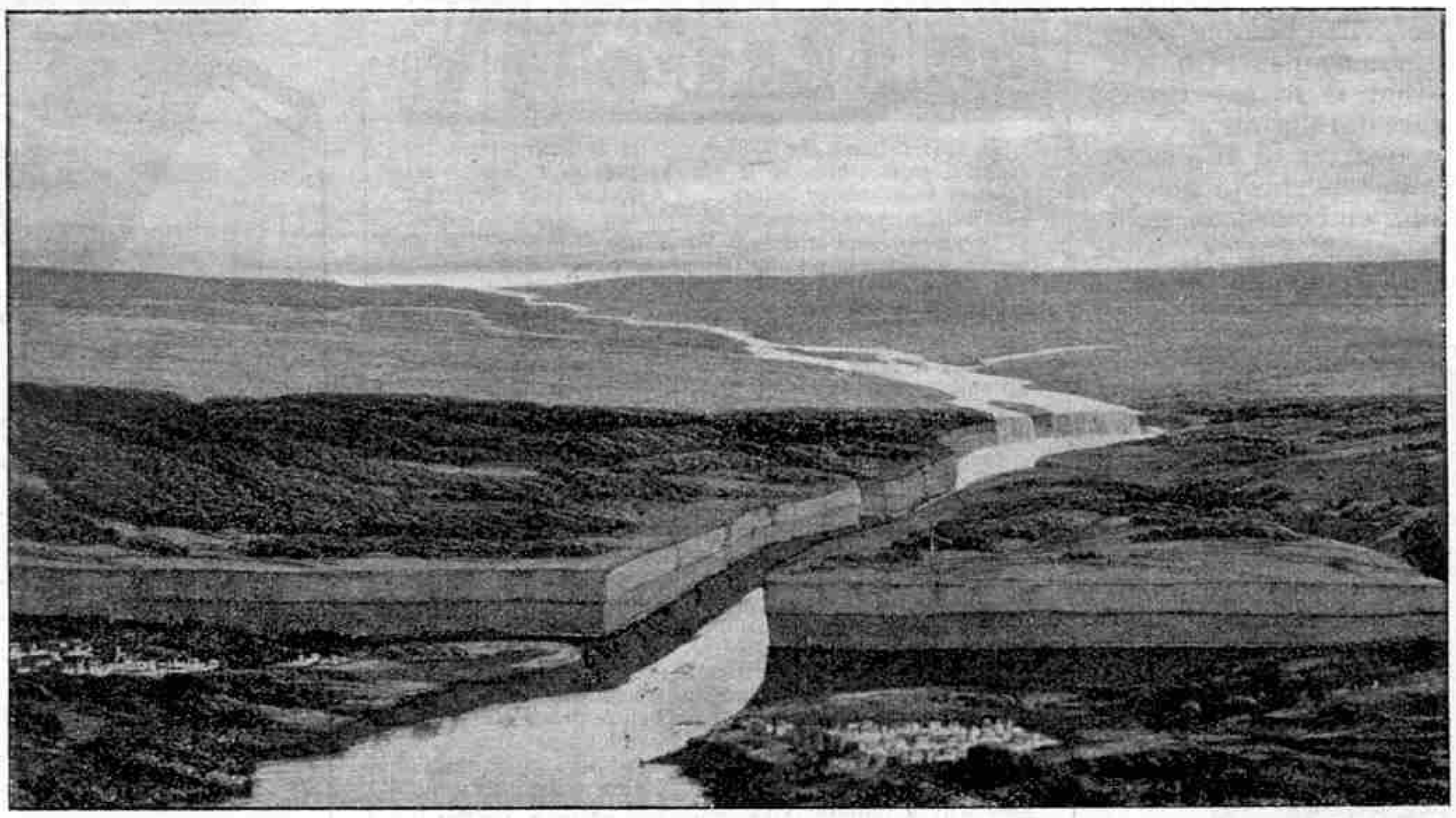
When the quantity of water flowing over the model represents an actual flow over the Falls of 100,000 cu. ft. per second, the American Fall appears thin and the crest of the Horseshoe Fall is almost bare for a considerable distance from Goat Island. If now two weirs are built out into the water, one from the Canadian shore and the other from Goat Island, the quantity of water flowing down the channel to the American Fall is increased and the bare spot of the Horseshoe Fall is filled up.

Similar experiments have been made with artificial islands in the place of weirs. In the channel leading to the American Fall are three islands, and it has been suggested that this Fall is maintaining its form practically unchanged because the presence of the islands results in the water being spread out evenly over the whole surface of the crest. Experiments on the model have led to the design of a chain of islands that bring about the same effect on the Horseshoe Fall as the weirs already referred to.

Careful consideration has been given to the results of the experiments made with the model, but it is not expected that such works as the construction of large artificial islands will be carried out on the Falls themselves. The model has shown quite clearly that remedial works are possible, but conditions in the turbulent waters of the Rapids above the Falls are too complicated and uncertain for complete reproduction in the model, and therefore the success of an experiment in the latter is not a sufficient guarantee that similar results will be obtained on the larger scale when the remedial work is carried out.

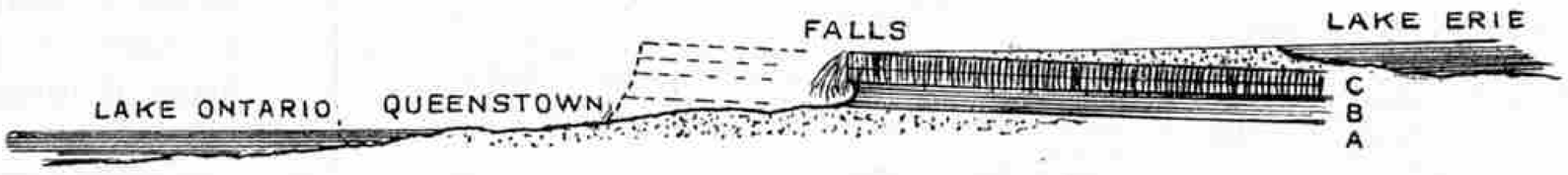
Steps are to be taken, however, that will improve the appearance of the Falls immensely. The most serious defect at present is the lack of water on the Goat Island shelf. To deal with this problem submerged weirs are to be constructed to deflect water from the heavy current nearer the centre of the stream, the passage of the water being made easier by excavation of the river bed in certain places. It is expected that a minimum of 4,000 cu. ft. of water per second will flow over the shelf when this work is completed, and that this quantity will be sufficient to fill once more the extensive gap at this end of the Horseshoe Fall.

On the Canadian side of the Falls similar operations are planned. Exposed boulders and shoals are to be removed, and submerged weirs to be built diagonally in such positions that they will distribute sufficient water to continue the crest line of the Fall right up to the shore, and re-establish also the Rapids above it. A third submerged weir is to be built higher up stream in order to divert more water to the stream on the American side of Goat Island. As already remarked, the removal of 56,000 cu. ft. of water per second has thinned the American Fall considerably, and it is hoped by this measure to compensate for the water withdrawn and to restore to the Fall its original appearance.



This illustration (from the Editor's book "Water in Nature" by permission of the publishers, T. C. & E. C. Jack Ltd.) shows a model of the Falls and the figure below shows, diagramatically, how the Falls have receded. The diagram below illustrates a section of the rocks at Niagara. A, the lowest strata, is sandstone, over which lies B, shale. Above this again is C, beds of hard limestone that become thicker as they approach Lake Erie.

The illustration above clearly indicates how the Falls have receded and formed a gorge through the flat plateau of rocks, which at one time extended unbroken to as far as Queenstown, half way to Lake Ontario.



The question of the level of water in the Great Lakes cannot be solved so easily as there are many factors to be taken into consideration that cannot be controlled by any human means. Negotiations may limit the amount of water used for sewage or canal purposes, but it is impossible to control the rainfall in the St. Lawrence drainage area. This reached its lowest point in the winter of 1925-26, and the flow of water from Lake Erie down the Niagara River in consequence fell to its lowest known level in February 1926. Since then the level has risen, and it seems likely that it will be many years before this low level will be reached again.

The works that have been planned will not prevent erosion completely, but there is good reason for confidence that the retreat of the Falls will not proceed continuously and rapidly until Lake Erie is reached! It has already been pointed out that the danger to the Falls arises from the undercutting effect of the water on the supporting shale. Where this action is now taking place the bed of hard Niagara limestone is 80 ft. in thickness, and a layer of shale 60 ft. in depth is exposed to erosion. The bed of limestone increases in thickness in an up-stream direction, however, and near the upper rapids it has been proved to be no less than 130 ft. in thickness. As the brink of the Falls recedes, therefore, the importance of the undercutting action will decrease and further recession will thus take place more slowly.

The cost of the works that are to be carried out has been put at £350,000. There is no sound basis on which to make estimates, however, and the engineers concerned simply state that the works will have to be carried on until the required effect has been obtained.

Binding the "M.M."

In response to many requests, we have arranged for binding cases for back numbers of the Magazine to be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases supplied in two sizes (1) for six copies, price 3/6 and (2) for twelve copies, price 5/3 post free in each case. The binding cases are supplied in what is known as "Quarter Basil, full cloth"—that is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather as shown below. The case is tastefully embossed in gold with the name "Meccano Magazine," and on the back is the name and volume number.

Binding Six or Twelve Copies

These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Whilst the binding of the twelve Magazines is quite satisfactory, they form a rather bulky volume and for that reason arrangements have been made to bind six months' Magazines where so desired, as explained above. Back numbers for any volume can be bound and the case will be embossed with the volume number.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool, carriage paid.

Wanted "M.M." Back Numbers

Since the announcement that arrangements had been made whereby back numbers of the Magazine could be bound up for permanent preservation, our stock of back numbers of several issues has been completely exhausted. Orders are still coming to hand, and in many cases we have had to disappoint readers who desired certain issues to complete their volumes for binding. The issues particularly required at the moment are:—January to March and September, 1924; January to April, August to October and December, 1925; April and May, 1926; January to March, 1927. Those readers who have copies to sell are asked to get into touch with the Editor stating the particular issues that they have for sale, and the price at which they are willing to sell (including postage). All copies should be in clean condition and complete with coloured covers.

The Editor wishes to make it clear that no copies should be sent to him until he asks for them.

OUR MAIL BAG



In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

L. Blake (Geelong, Australia).—Your suggestion for a general knowledge section in the Magazine is quite good and we may introduce something of this kind at a later stage. The difficulty is mainly one of space, and there is also the further point that many readers seem to prefer to have their questions answered by letter, as is the case at present.

Mr. N. R. P. Daniels (Bath).—"My reason for sending for a specimen copy was to see if it was suitable to take for my son, but now I think I shall take it for myself, and just let the son look at it over my shoulder!" At first we thought this was a clear case for the N.S.P.C.C., but afterwards we came to the conclusion that you were trying to pull our leg! We expect the matter will end in a compromise and that you and your son will read the "*M.M.*" together.

R. H. Gordon (Cambridge).—You are very wise to have your Magazines bound but we think that it would be a pity to remove the covers before doing so as the general appearance would then be much less attractive.

S. W. Lemm (S.E. 15).—"First of all I must thank you for your very nice letter. I can well understand now why a million boys claim you as their friend, if you answer all letters as you have answered mine. May your army of friends increase 100 per cent.!" We hope your wish will come true and we are not in the least scared at the prospect.

K. Stuart (Sheffield).—Your letter rather took our breath away, but we recovered quickly. We hasten to assure you, in reply to your anxious query, that editors are not made of reinforced concrete and that, provided they are not aggravated too much, they neither growl nor bite! Send another of your cheery ietters very soon.

Mr. G. Ludlam (Heckmondwike).—We hope to contlnue to deserve your good opinion. We greatly appreciate your comment: "It is fine to know that such a Magazine exists to promote good fellowship between boys all the world over, uniting each and all in a bond of friendship."

F. Day (Barrow-in-Furness).—You were very fortunate to be able to look over the Australian liner before she left the shipyard. We quite agree that the construction of a big liner is one of the finest of all examples of the engineer's skill and we hope to have a series of articles on ship-building in the near future.

W. S. Tuckett (Melbourne).—You will be interested to know that Mr. Allen is preparing an article on one of your Australian expresses. The photograph of the Pacific locomotive you sent is very interesting and we may be able to reproduce it before long.

G. Watson (Birmingham).—Your suggestion that the "*M.M.*" could be published more frequently if we employed a few more Editors startled us considerably! We are afraid, G.W., you do not realise that to collect three or four Editors under one roof would be nearly as bad as confining three or four strange tigers in one cage!

H. Standen (Huntingdon).—"I have started work at the local auctioneer's office as a clerk and I think it much more fun than going to school." We are glad to hear this, Henry. Almost all work is fun if tackled in the proper spirit—it is only the half-hearted grumbler who finds work a drudgery. We will do our best to carry out your suggestion to increase the distance between the covers of the "*M.M.*"!

W. Burnet (Luton).—"My father, or 'Pop' as I usually call him, at first declared that Meccano was only a toy, but when I constructed a drill that bored a hole in his hand he became quite enthusiastic"! We are glad that you have convinced him, but we would suggest that in future you adopt a less strenuous type of propaganda!

H. Michel (London, E.8).—There should not be any difficulty in our finding you a friend who will correspond in Esperanto. We agree that Esperanto is well worth learning, but most boys seem to find their school studies quite sufficient without taking on another language. You will hear from us as soon as we can fix you up.

P. Adams (Weston-super-Mare).—"I have a blank cartridge shot pistol; it's awfully nice and it makes the maids jump"! We have no doubt that you are having a real good time with the pistol, P.A., but we hope you will not fire it off when the maids are carrying some of your mother's best china, otherwise someone else may do a little jumping! We shall be interested to hear if you have succeeded in building your fire engine.



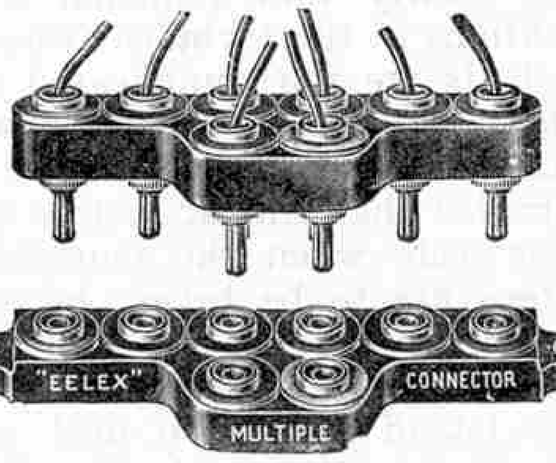
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OUR BUSY INVENTORS

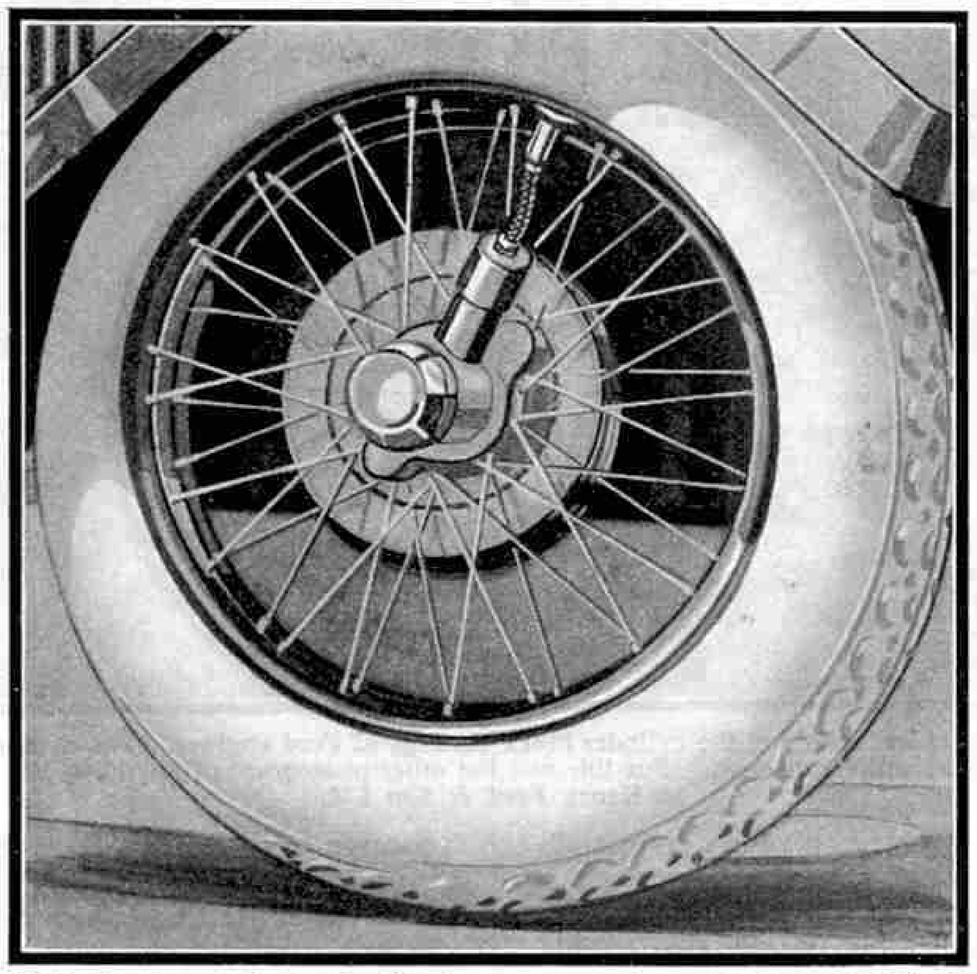


Automatic Tyre Inflator

A distinctly novel pump for keeping a tyre inflated to its correct pressure is now being manufactured in America. It is operated by the rotation of the wheel itself and as it is quite automatic in action, car-owners using the device are relieved of much of the troublesome attention to tyres that is usually necessary.

On the spindle of the wheel a hardened cam is mounted in a convenient position below the hub plate. Attached to the wheel is a tiny air pump, the piston rod of which follows the cam as the wheel rotates, the compression stroke being thus completed when the end of the piston rod reaches the peak of the cam. The action is similar to that by which the cams on the cam shaft raise and lower the valves of the engine, the only difference being that the cam that operates the air pump is stationary. The lower end of the piston rod is fitted with a roller that follows the cam without friction and a spring is used to bring the piston back in preparation for the next compression stroke.

So long as a wheel fitted with this pump revolves, the pressure of the air in the tyres is kept up even when a slow leak or a small puncture is causing continuous loss. As the pump never stops working and would eventually raise the pressure inside the tyre too high, a second valve is provided. This only opens when the pressure inside the tyre reaches its correct value, and thus surplus air is discharged into the atmosphere.



This device automatically keeps a motor car tyre inflated at the correct pressure

* * * *

A Boat that is Screwed through the Water

Reference has recently been made in the *"M.M."* to several inventions that have aimed at increased speed for ships. Still another idea is now being tried with the same object, but this time an entirely new principle is involved. Instead of propellers of the ordinary type fixed at the rear of the boat, two French mechanics propose to use metallic screws along each side. These are enlarged copies of the ordinary screws that penetrate into a piece of wood when turned by a screwdriver, and the idea is that when rotated they will grip the water and travel through it in exactly the same manner. It will be remembered that this principle has been applied to snow travelling in the successful snow motor described in the *"M.M."* for December last.

The inventors succeeded in making a boat to their design but they were unable to give a demonstration on account of lack of money to instal an engine. They approached the French Ministry of Marine in the hope of obtaining assistance but met with a very cool reception, as the officials immediately declared that the idea was impracticable. Unwilling to abandon their work, the inventors persuaded an acquaintance to give them a worn-out motor car and they managed to adapt the 40 h.p. engine from this to serve as the motive power of their boat.

A trial trip was then made but the boat travelled only at a speed of 12 miles per hour. The inventors attribute this disappointing result to the age and inefficiency of the motor which, instead of its normal 40 h.p., actually developed only 5 h.p. With a really efficient and high-power engine and a boat constructed on proper lines they expect to reach a speed of 60 miles an hour without any difficulty.

* * * *

Engine with High Compression Ratio

During recent years there has been a decided tendency to increase the compression ratio of internal combustion engines in order to obtain higher efficiency. With ordinary petrol a limit is set to this ratio by the fact that the heat developed in compression raises the temperature so high that the mixture is ignited before the proper time. This can be avoided by adding to the petrol a proportion of such a liquid as lead tetra-ethyl, the chief constituent of the now familiar Ethyl petrol.

Another interesting method that is very simple in principle has been suggested by a Swedish engineer, who has invented an engine in which the explosive mixture is cooled to keep its temperature below self-ignition point. The inventor makes use of a special additional cylinder alongside the engine cylinder for this purpose and cools the mixture by expansion, just as the working fluid of a refrigerating plant is cooled.

In the extra cylinder is a piston of the same length of stroke as the working piston. This piston is moved by the crankshaft, but the crank pin is so placed that it is at the top of its stroke when the normal piston is at the bottom, and vice versa.

During the compression stroke of the engine, the auxiliary piston moves downward and draws air into the cylinder in which it works. In the two following strokes this air is first compressed and then expanded. The first process increases the temperature, which is prevented from rising too high by the cooling water that circulates round the cylinder head. The expansion that follows causes a very considerable cooling, in which it is said that the temperature of the gas actually falls below the freezing point of water.

The subsequent up-stroke coincides with the inlet stroke of the engine. The two cylinders are in connection through the inlet valve, and the cold air therefore is pumped into the explosion chamber along with the mixture, the temperature of which is so much reduced that it may be more strongly compressed than in ordinary engines. Compression ratios as high as 8 to 1 have been attained by this method, with a corresponding increase in power compared with ordinary engines, in which the ratio is 5 or 6 to 1.

If air is employed as the cooling medium, attention must be paid to the composition of the mixture used, in order to prevent the cold air from diluting it too much for efficient working. Alternatively, the cooling operations may be carried out with the explosive mixture instead of air.

There is a tendency to use higher pressures also in steam engines, both stationary and locomotive. The engines of the future will probably have small boilers that supply steam at enormous pressures, and their power will be so great in proportion to their weight that it will even be possible to use them in aeroplanes.

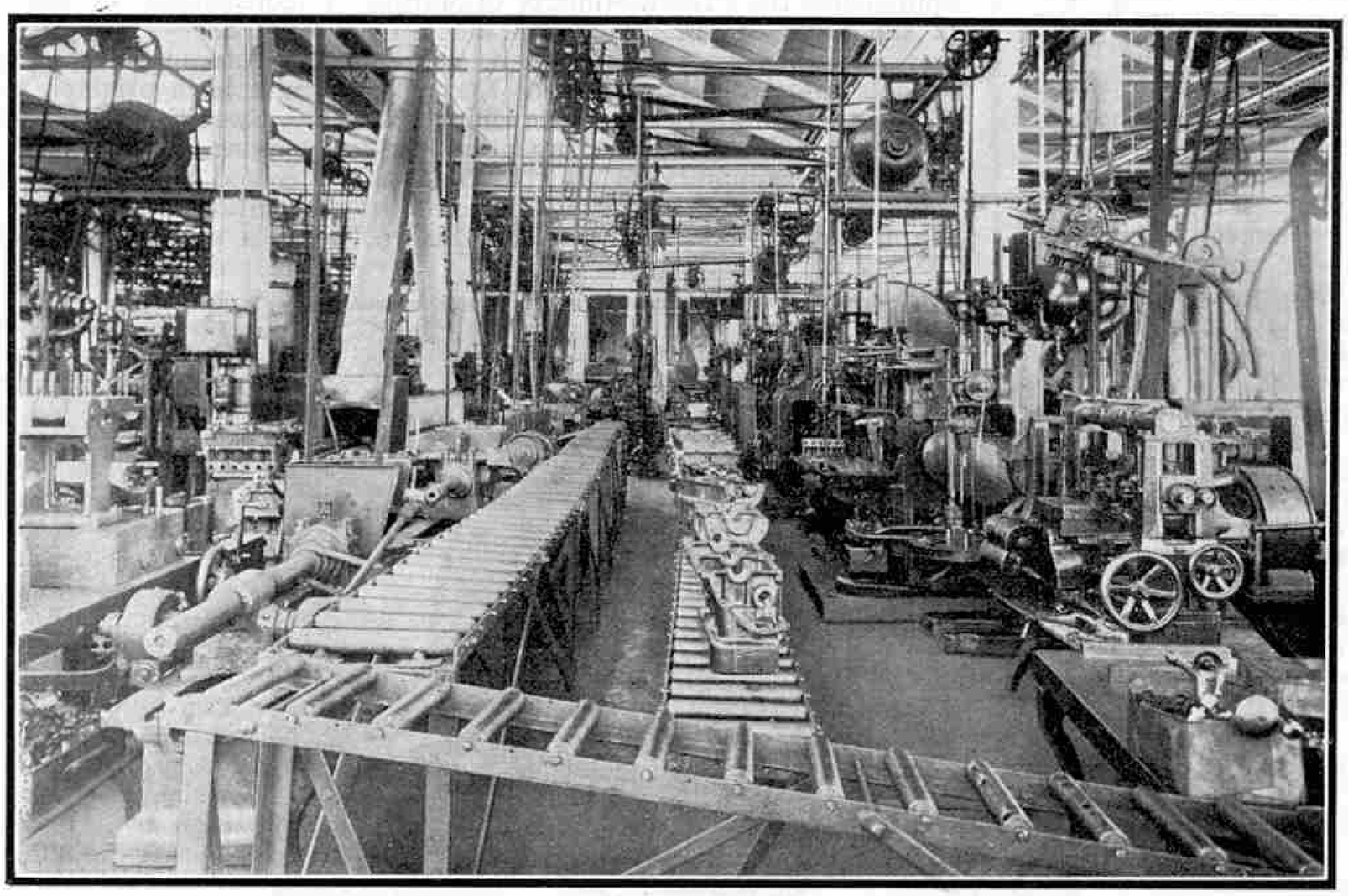
The Story of the Motor Car

IX.—How Mass Production Began

WE are so accustomed to seeing constant streams of motor cars and lorries on the roads to-day that we find it difficult to believe that they were expensive luxuries little more than 20 years ago. There are several reasons to account for the change. One of these is that engines are now more powerful and reliable. Another is that cars are so much simpler in construction that owner-drivers are able to keep them in order and seldom need the services of a trained motor mechanic.

Even with greater reliability and simplicity the growth of the motor car would have been much slower if mass production had not been introduced. This came from America and the idea behind it is to reduce the cost of cars by doing away as far as possible with the making of component parts by hand labour, and employing instead machines specially designed to turn out individual parts in enormous numbers and with perfect accuracy.

When the project was first introduced its sponsors believed that the extra cost of the machinery would be more than returned if the output were large enough, but many manufacturers doubted this. It is true that it cost money to set up the plant required, for instance for making cylinder blocks, and it is easy to see that if only a few parts are made by means of it their individual cost will be very great. If the number of cylinder blocks turned by the same plant is very greatly increased, however, the expense of installation is divided among them and the cost of each is greatly reduced. It was soon found that this reasoning was quite correct, and the low price of cars made by the method led to a very large demand. This in turn led to a further reduction in cost that increased the number of possible buyers.



The lines of machines used in furnishing the cylinder block castings of Ford engines. The castings are pushed from one machine to the next on the roller conveyor. For this and the other photographs illustrating this article we are indebted to Henry Ford & Son Ltd.

The first American mass production cars were rough in appearance, as no money was spent on anything that was regarded as an unnecessary refinement. Their reception in other countries was at first a little unfriendly, but a few practical trials soon showed their capabilities. In 1908, for instance, three Cadillac cars were taken to pieces after being severly tried on the road, and three new cars were then assembled from parts selected at random. The rebuilt cars proved to be as good as those from which they were made, and successfully completed high speed trials on the Brooklands track.

To-day mass production is always associated with the name of Henry Ford. He was the first to use the method on a really gigantic scale and to produce a useful car at a very low price. His famous Model T Ford car first appeared in 1909, in which year 10,000 cars were sold. This was regarded as an enormous number, but three years later the annual sales reached 168,000 and in 1915 rose to more than half a million. The output continued to grow rapidly until in 1924 nearly two-and-a-quarter million vehicles were actually sold.

Many funny stories have been told about the Ford and about the manner in which it was made, but it was far too useful to be sneered at or disregarded. Henry Ford is, in fact, the genius of the motor car world. He made motoring for the million possible by producing a car that was cheap and easily handled, and Fords became almost as common as bicycles or sewing machines. Other manufacturers began to make use of similar methods, and to-day thousands of cars are being produced weekly in great factories on both sides of the Atlantic.

The first and most important step in manufacturing cars on mass production lines is to settle on the design. Once production has commenced this cannot be changed except at very great expense, for the least alteration means providing new tools and jigs, and may even require entirely new machinery.

One of the greatest marks of Ford's genius is that he designed a car that did not become out of date until almost 20 years later. As soon as its designer became convinced that an entirely new model was necessary he began to plan a car that should incorporate every possible improvement. The cost of the change-over from production of the old model to the new ran into millions of dollars. This did not worry Mr. Ford. The new model is quite sound from an engineering point of view and is expected to remain in production long enough to repay the enormous sum spent in re-organising the factories.

It is interesting to note that the chief alteration is in the gear box. When the original Ford car was designed, a satisfactory gear box of the ordinary kind was expensive, and a simpler type in which the gears were always in mesh was therefore used. Well-hardened gear wheels are now more easily and cheaply made and their design makes gear-changing less of an ordeal to drivers than it was 20 years ago. Thus the new model has sliding gears, as used in other cars, because this represents the best modern practice. Four-wheel brakes also are fitted for the same reason.

The design to be used must also be carefully considered from the point of view of manufacture. If a car is to sell at a low figure the process of making it should be as simple as possible. It is inevitably a very complicated product, however, and many of its parts undergo a very large number of operations before they are ready for assembly in the chassis. Their number must therefore be reduced as far as possible and their construction simplified in order to keep down production costs.

When the design has been finally settled and the necessary machines and tools have been prepared, the layout of the factory must be carefully planned in order to enable work to be carried on smoothly and quickly. A visit to the Manchester works of the Ford Motor Co. Ltd. shows how important this is. There a complete car is built up on a chassis frame as it passes slowly along between two lines of workmen. The machinery is so arranged that, as each part is finished, it is brought automatically

to its proper place in the assembly line. Thus the last operation on the wheels is to put on the tyres and inflate them. They are then passed directly to the workmen whose task is to fix them on the chassis. Other parts are dealt with in a similar manner. There is no delay, as they are brought to the fitters' hands when they are required.

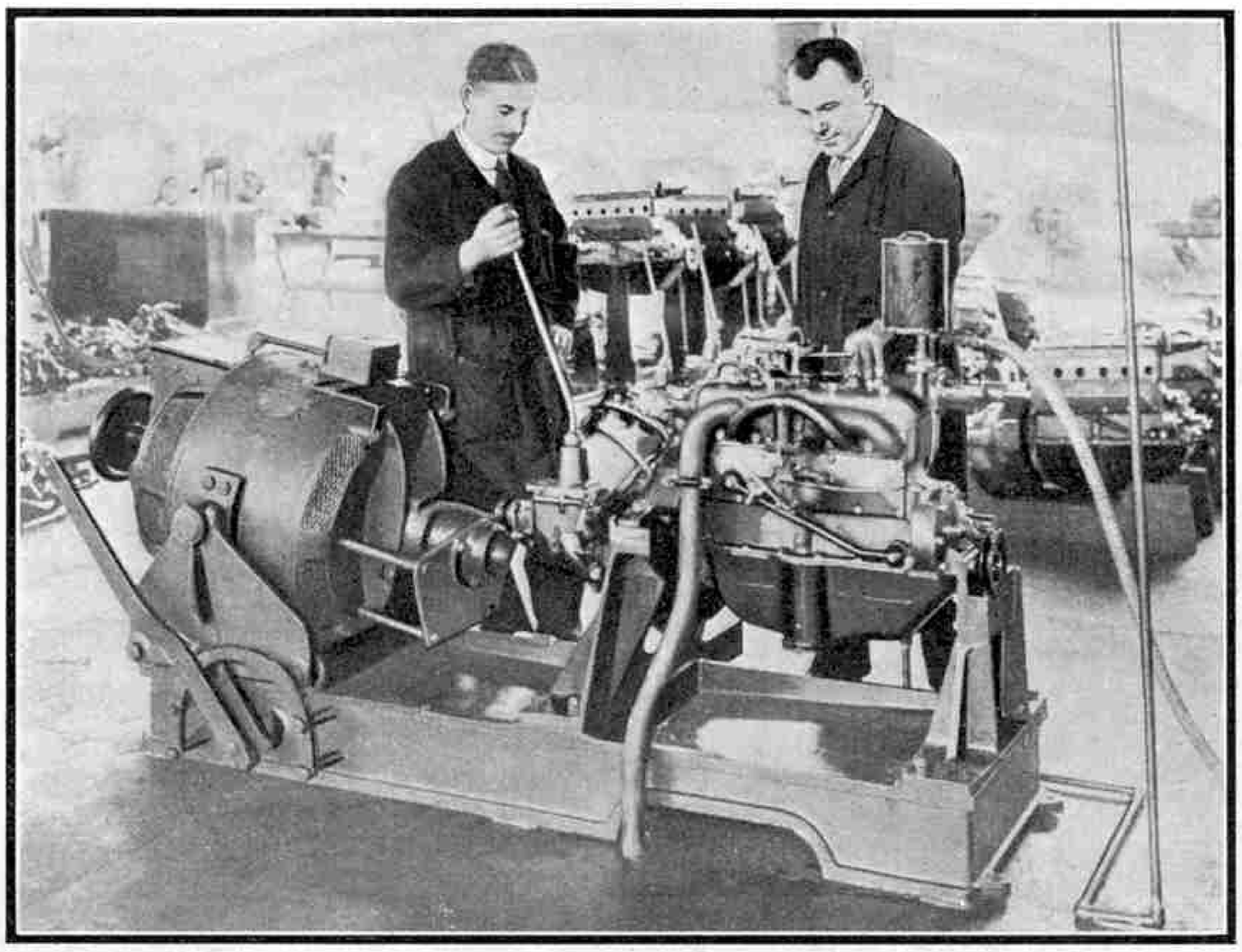
Conveyors play a very great part in the organisation of a mass production factory, where they are used to pass work from one machine to the next. For parts that are too heavy to be moved in this manner, overhead cranes of all types and sizes are used. These enable the workmen to swing new parts into position with a minimum of effort. The cranes at Manchester are actuated by compressed air, which is very largely used for power purposes throughout the Ford factories.

Incoming material enters each department at one end and passes down the room in the course of the necessary operations. When the finished article arrives at the delivery end it is inspected. If found satisfactory it is then loaded on a trolley to await removal to the stores or to the assembling department. The trolleys are drawn by Ford chassis that have been cut down to approximately half their length. This has been done in order to make them small enough to turn in the narrow spaces between the lines of machinery. Some of them run on rails and are capable of hauling as much as 10 tons.

The principle of using machinery to the utmost extent is faithfully followed in the Ford factories and any new machine that will increase output still further is introduced immediately its value has been proved. Thus the departments in which the components are made display a bewildering variety. Huge presses stamp out wings and frame-members from sheets of metal of various thickness as easily as if they were sheets of paper. Many parts are drop-forged and the thud-thud of the hammer as it shapes them on the dies placed underneath almost deafens the visitor. Casting figures as largely in the preliminary work as it does in building steam locomotives. The cylinder block of the engine is one part made in this manner.

In other departments the rough castings and pressings undergo further treatment. The castings are machined to size and the necessary holes drilled. For the latter operation very complex and remarkable machines are used, one of which drills no fewer than 42 holes in one operation! It is used to bore all the holes required in a cylinder block, and a similar machine completes the work by reaming the eight openings through which the valve stems pass. Lathes of all kinds are also in use for finishing and thread-cutting.

The work carried on is of surprising complexity. Even such a small part as a hub cap undergoes four different operations. It is first blanked out from sheet brass and then pressed into its final shape. The necessary internal thread is then cut on a capstan lathe and the cap finished by electro-plating. The machines required for these operations are arranged in line so that the parts turned out on one may quickly be passed on to the next. The slowest operation is the cutting of the thread. The operations have been made practically automatic, however, and on the lathe used 300 hub caps are threaded in one hour.



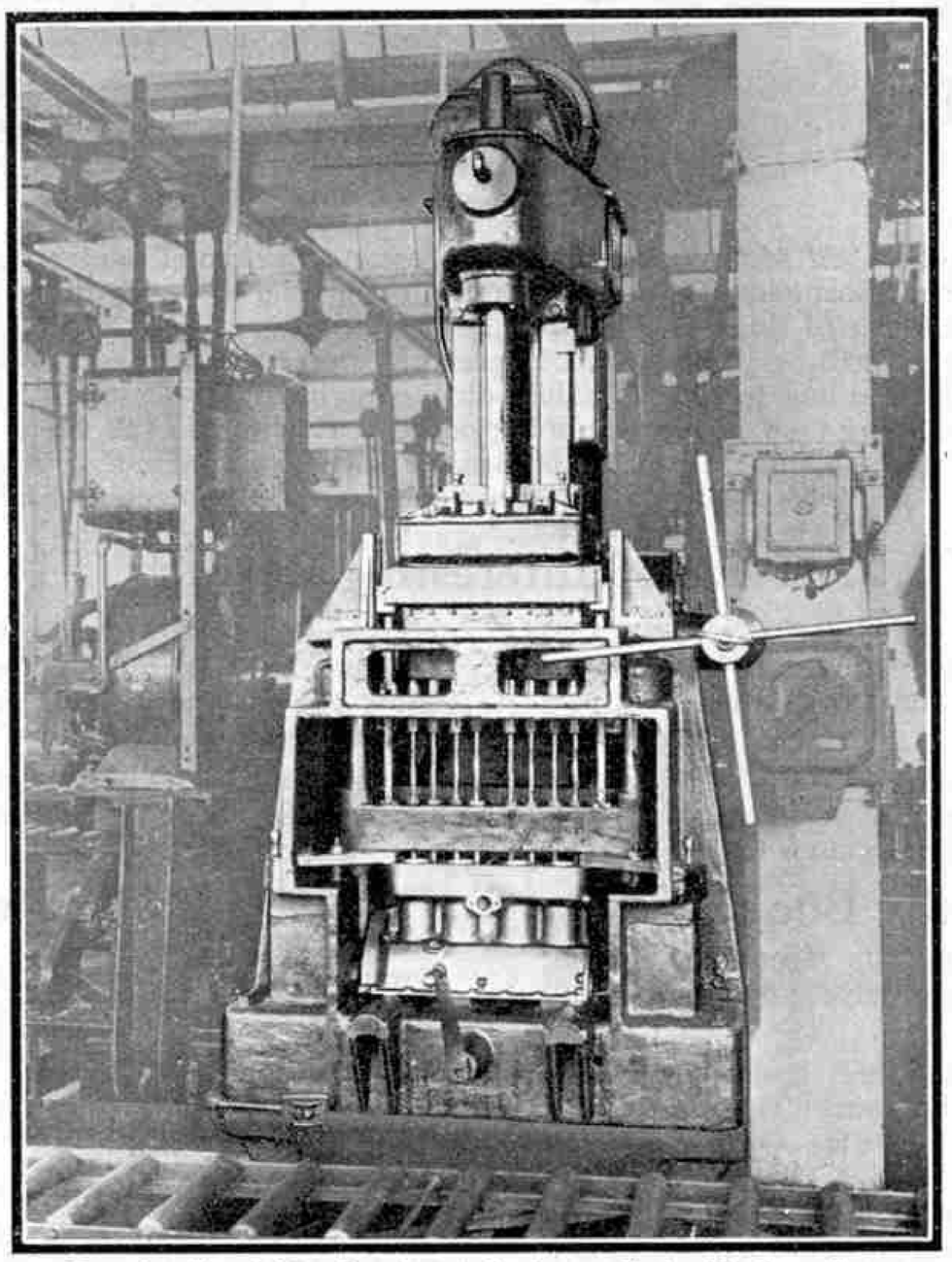
A line of running-in stands at the Ford Works. Electric motors are used to drive the engines at high speed

Similar arrangements are made for work on other parts. The radiator is an interesting example of the complex nature of almost every part that goes forward to the assembly line. It is made by passing 95 vertical copper tubes through holes in 97 horizontal brass fins. The process of making it commences with the feeding of copper strip through a machine that twists it into tubular shape and passes it through a bath of molten solder to make a sound joint. A second machine stamps out the fins. Eighty of these are produced every minute, and the same operation punches the holes for the tubes to pass through and others for air circulation. A sufficient number of tubes and strips are then placed in two jigs and the tubes threaded through the holes. The top and bottom tanks are then pulled on and soldered into position.

An interesting feature is that when the tubes are being made they are covered with solder on the outside. The result is that when the radiator is complete the tubes are found to have been soldered to the fins by the heat to which it has been subjected. Thus the cooling fins are in good contact with the tubes through which the hot water circulates and the heat is quickly conducted away to them.

The complete radiator is placed in boiling water to detect any leaks and is left there for 20 minutes. The positions of any holes are shown by the escape of air bubbles, and the weak places are immediately soldered up. This is not often necessary, however. To complete the test the internal air pressure is increased to 12 lb. per sq. in., and no radiator is regarded as satisfactory unless it shows no sign of leakage under these conditions.

When the various components have been completed they are taken to the assembly department, where they are built into complete cars. To visitors this is the most interesting portion of the whole factory. It is very fascinating to watch a skeleton framework growing into a complete car that is finally driven off under its own power. At each stage in its progress down the assembly line a chassis is surrounded by workmen, who add parts or adjust others that have already been placed roughly in position. Although speed is important, there is no hurry and bustle. The time required for each operation has been carefully worked out and the line of unfinished cars moves at a rate that allows the men to perform their tasks thoroughly. Next month we hope to explain this interesting work more fully.

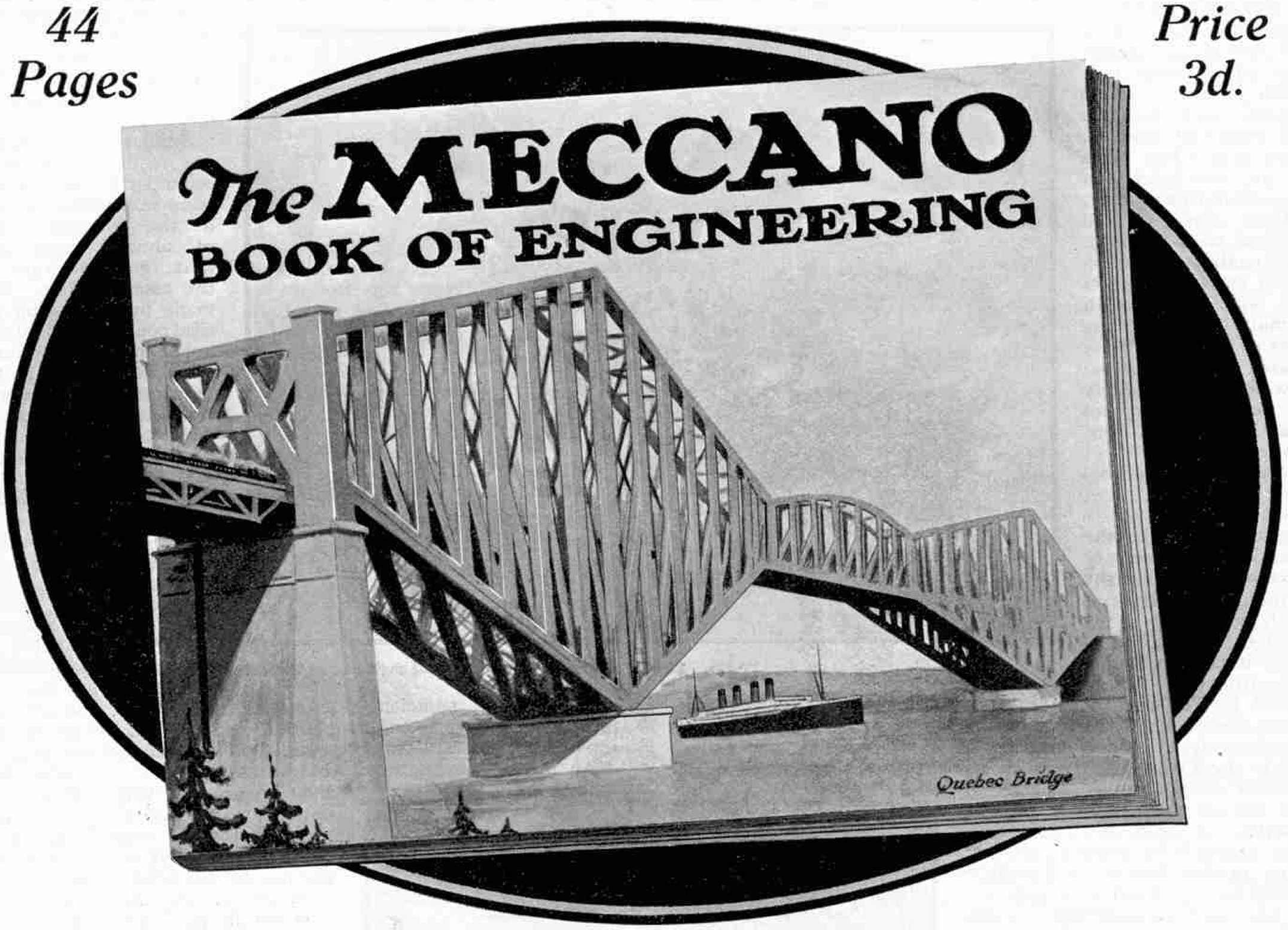


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How Engineering will Develop

A Peep into the Future

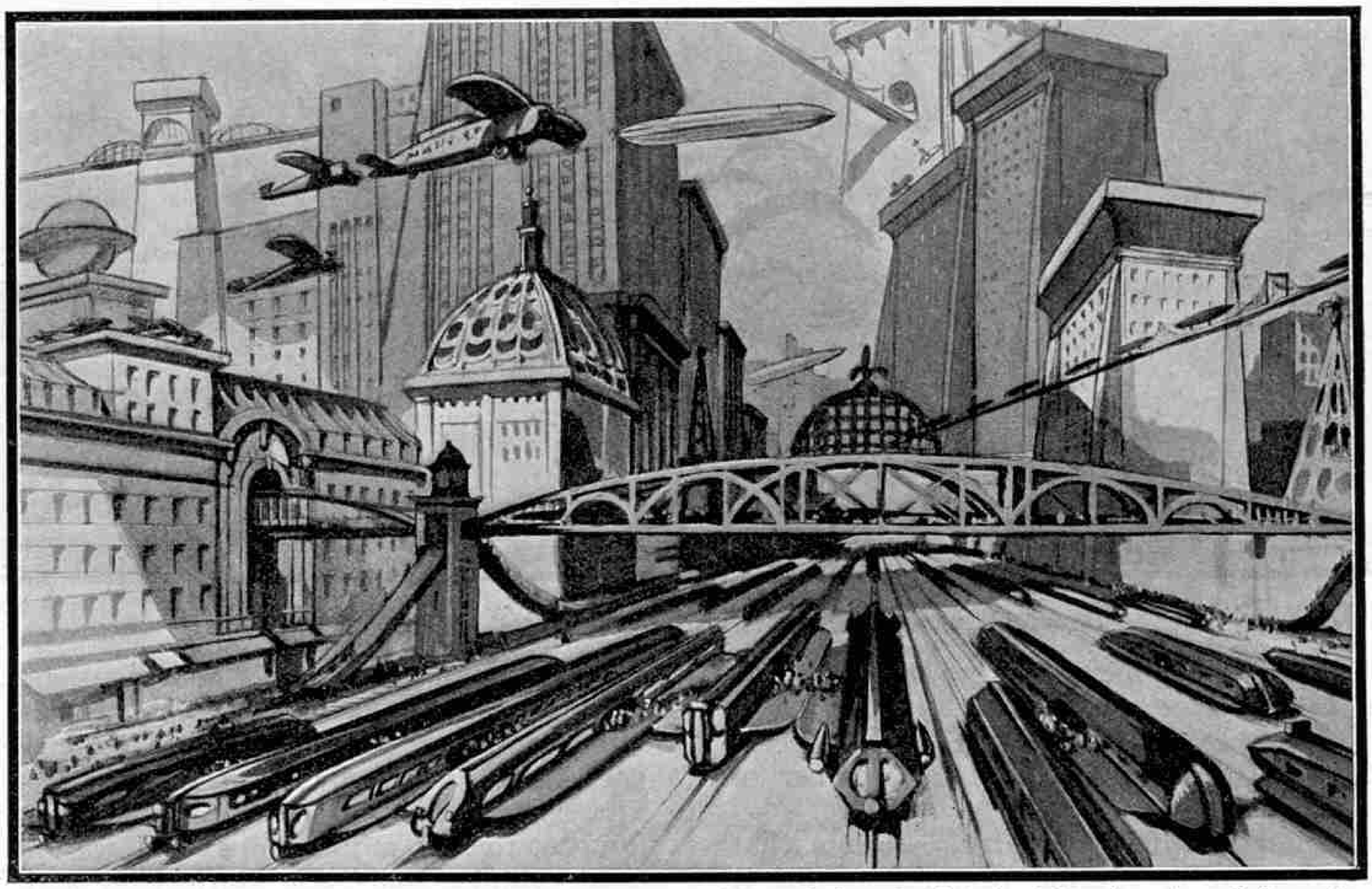
IT is always interesting to try to peep into the future and to visualise the changes that will take place in the daily life of the world. Such speculations are particularly fascinating in regard to engineering, because it seems fairly clear that human life is bound to become more and more dependent upon mechanical appliances as the years go on. Countless operations that comparatively few years ago were carried out by hand are now entirely mechanical and there is little doubt that this process will continue.

It is sheer waste of time to try to forecast in detail the engineering developments of the future, but we may profitably consider certain broad lines upon which progress is likely to be made. For instance, let us take the case of building materials. At present we are living in the age of iron, but in many respects iron is an unsatisfactory metal. It is used on such an enormous scale in industry and in constructive engineering because we do not know a more suitable metal, but it has the great drawback of being easily corroded and rusted. It has been calculated that the annual loss from rusting and corrosion amounts to no less than £500,000,000, and yet the only practical method that has been available until recently for protecting iron from rusting has been the liberal use of paint. The comparatively recent introduction of rustless steel may possibly put an end to this waste and maintain the present position of iron as the world's primary structural metal. Rustless steel is really an alloy containing about 13 per cent. of chromium. It is resistant to most forms of corrosion and is likely to find an increasing number of industrial applications such as in hydraulic pumps, and in dock, bridge and ship construction.

It is difficult to say what new metal or alloy will be developed to take the place of iron and steel. Aluminium or magnesium may come into extensive use in some form or other, as alloys containing them combine lightness with other valuable qualities, and research work may result in the production of alloys having the necessary strength.

As far as reservoir and dam construction and, in a less degree, bridge building are concerned, the use of reinforced concrete makes standardisation comparatively easy. Ferro-concrete blocks of standard sizes may be made without any difficulty wherever they are required, or alternatively concrete may be poured directly into its final position by making use of standard moulds. This method has been introduced already in America, where it is employed in the erection of the huge buildings for which that country is famous. Another interesting and important feature of concrete is that its introduction will help in conserving the supply of iron. A considerably less amount of the metal will be required and in addition it will be protected by the concrete in which it is embedded from the corroding effect of moist air.

Enormous developments are clearly indicated also in regard to transport, and these probably will be mainly in the direction of increased speed. It has been suggested that some form of moving way will provide the means of travelling in the future, and that it will be possible to travel from London to Liverpool, for instance by simply stepping on to a series of platforms moving between the two cities like endless belts. These platforms will move at varying speeds in order that passengers may first board the slowest and work up to the fastest by stages that do not involve any sudden and uncomfortable increase in speed. Presumably these moving ways would be furnished with adequate waiting-rooms and lounges in order that journeys may be made in comfort at least equal to that of the present-day Pullman coach. Methods of this kind undoubtedly would prove very valuable, especially within the restricted area of a large community or city.



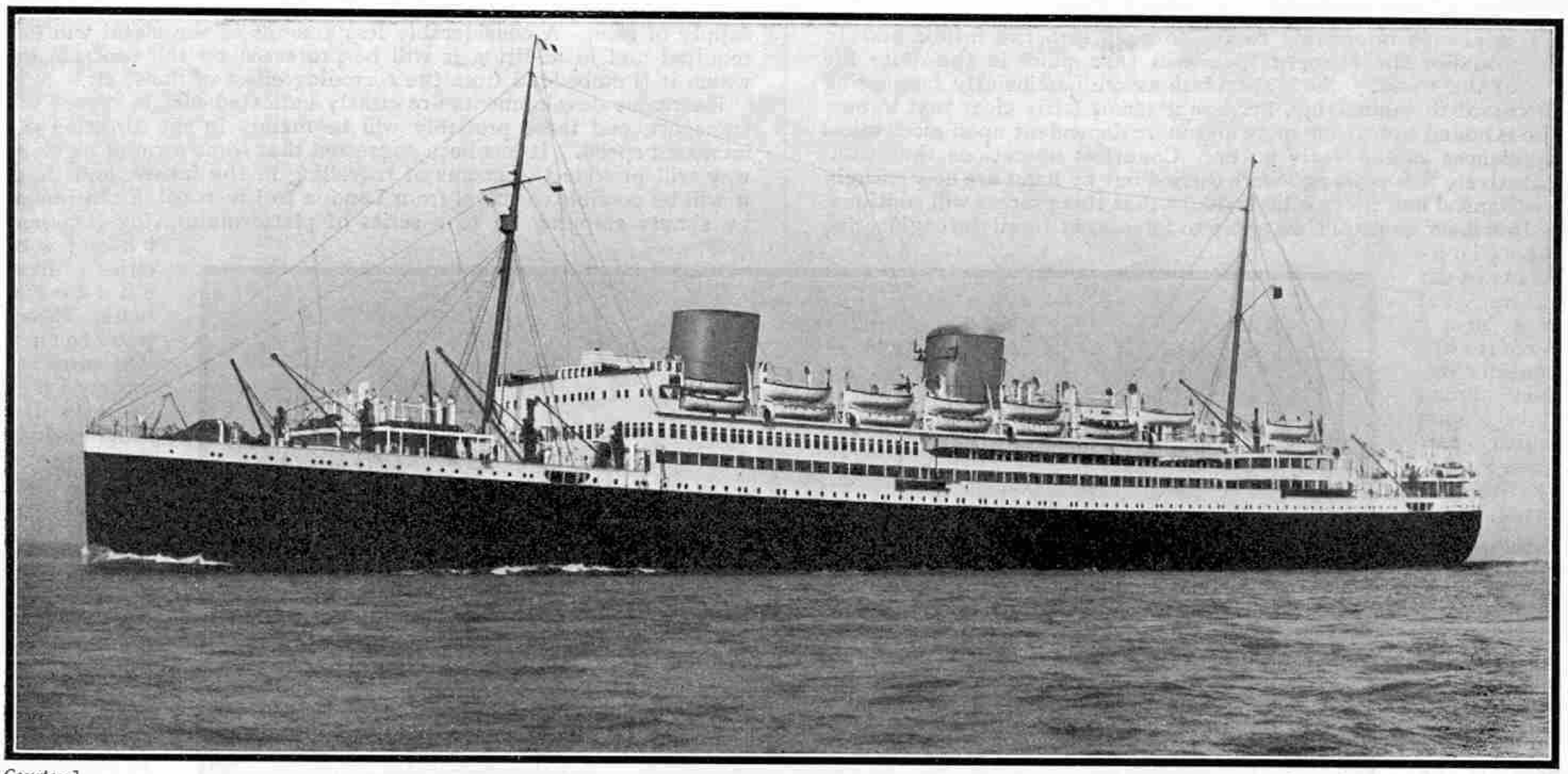
Perhaps Piccadilly will look like this in the year 2000, with lines of fast suburban electric trains taking the place of the motor traffic of the present day

Another interesting point concerns the fight between the rubber-tyred wheel and the wheel designed to run on rails. The struggle will probably be won by the latter, for two reasons. In the first place, the population of the Earth will undoubtedly increase so greatly that there will be no space left available for rubber plantations, every possible acre of ground being required for food-producing purposes. Secondly, the future development of light alloys already referred to will make the production of rails and metal wheels on a large scale a comparatively easy matter.

Readers who are interested in these matters should make a point of obtaining the "*Meccano Book of Engineering*," which deals with the engineering of the future in detail and with several illustrations. In addition the book contains a fascinating account of how the growth of the world's civilisation has been made possible by the engineer. Another long section deals with the building of the Quebec Bridge and describes how in the face of two disasters engineers persevered and ultimately succeeded in completing one of the most marvellous engineering structures in the world. The methods employed in the carrying out of the vast irrigation works proceeding in India and elsewhere are described with special reference to the stupendous amount of work accomplished by the dragline excavator. Finally, a particularly interesting section shows how the engineer holds back the sea and tells the story of the development of harbours and breakwaters from the crudest beginnings up to the magnificent structures of to-day.

Two Great Motor Passenger Liners

"*Asturias*" and "*Alcantara*"



Courtesy] [*Royal Mail Steam Packet Co.*

A broadside view of the "*Asturias*," the largest motor liner afloat

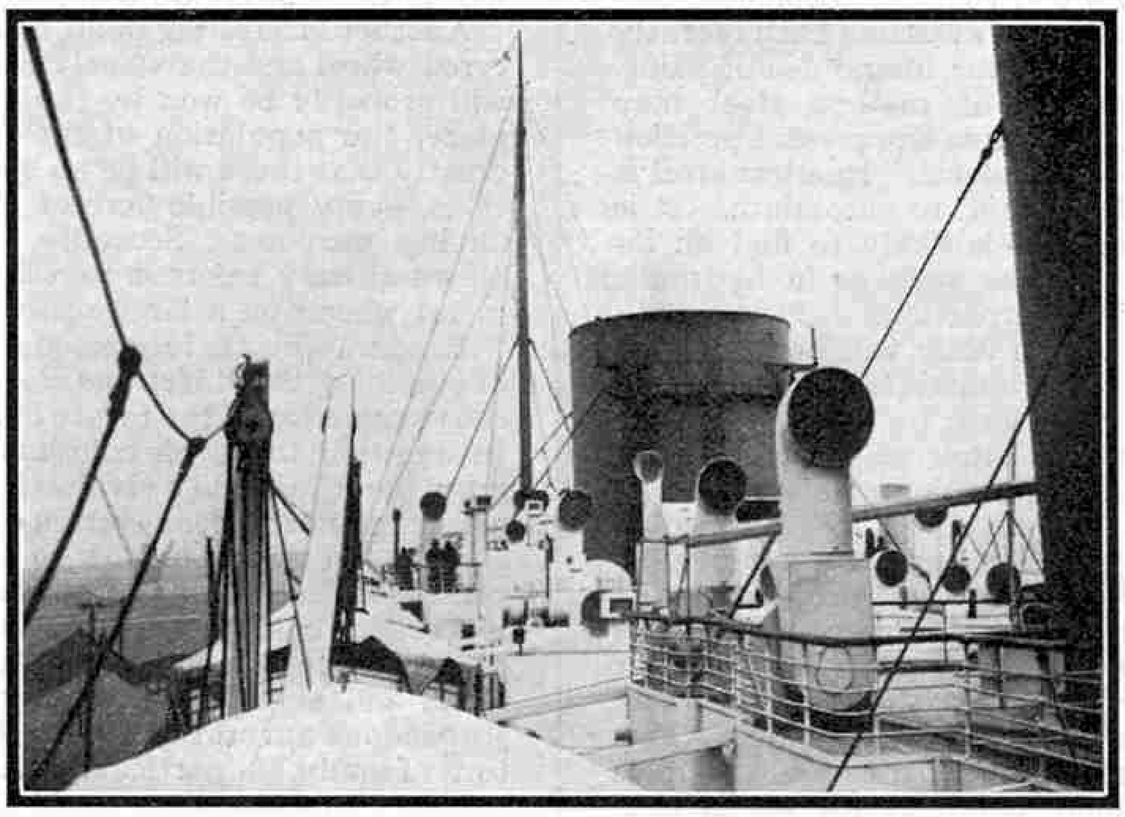
THE remarkable development of the Diesel engine that has taken place since the first of that name was introduced by Dr. Rudolph Diesel 32 years ago is reflected in the rapidly increasing number of motor ships afloat.

The original Diesel engine had certain defects that delayed its application to marine propulsion, but it was sufficiently practical under demonstration to give definite promise of big things to come. It was quickly realised that if the engine could be adapted to ship propulsion it would effect a substantial saving in many directions. For one thing, a considerable reduction in engine space would be possible, with a corresponding increase in cargo space. The number of men required to run the engines would also be greatly reduced, as stokers and coal trimmers would not be required.

In December 1910 the first sea-going motor ship equipped with engines operating on the Diesel principle was built in Holland. This was the "*Vulcanus*" of 1,180 tons gross, with a Werkspoor four-cycle 650 I.H.P. Diesel engine. In the following year a much more ambitious engineering event was the completion of the East Asiatic Company's 7,500 ton motor vessel "*Selandia*" at the Copenhagen yard of the well-known firm of Burmeister and Wain. The "*Selandia*" is regarded as having set the fashion for ocean-going motor ships, and was fitted with two eight-cylinder four-cycle Burmeister and Wain marine Diesel engines, giving a total of 2,500 I.H.P.

During the past few years the adoption of internal-combustion engines for ship propulsion has increased enormously, and at the close of 1926 the total tonnage of motor ships under construction was practically equal to that of steamships then building.

In the "*M.M.*" of October 1926 we described the Swedish-American Lines' twin-screw motor passenger liner "*Gripsholm*" of 17,716 tons gross, which is equipped with two four-cycle double-acting six-cylinder Burmeister and Wain marine Diesel engines. The great strides made in the development of the Diesel type of engine may be gauged from the fact that the two engines installed in

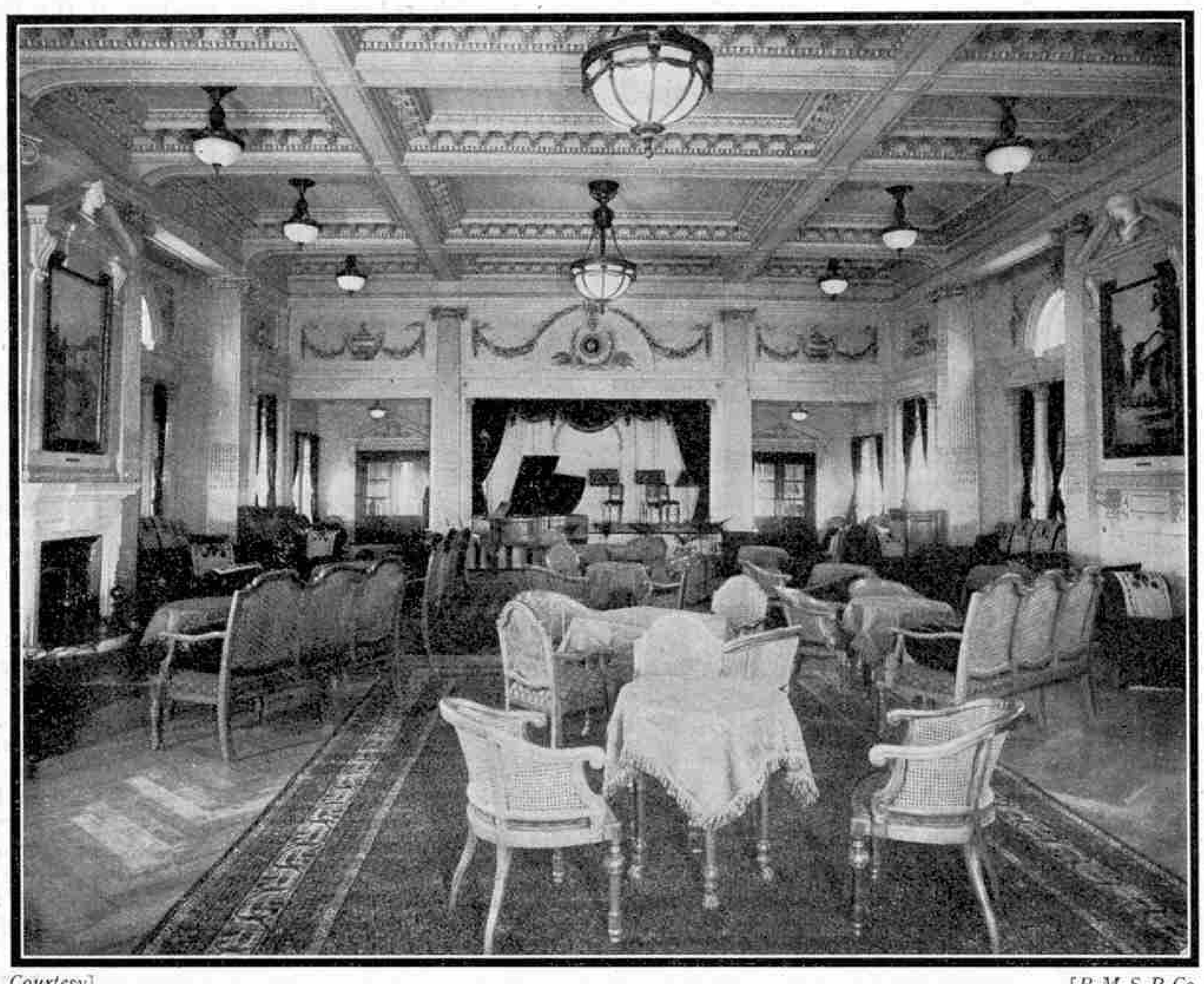


Courtesy] [*R.M.S.P.Co.*

A view of the boat deck of the "*Asturias*"

this liner, built in 1926, give a total of 16,300 I.H.P. or 13,500 brake horse power.

These figures were exceeded in the same year, however, in the new motor passenger liner "*Asturias*," and more recently in her sister ship the "*Alcantara*." Both these mighty vessels were constructed and engined by Harland & Wolff Ltd., Belfast. As the "*Asturias*" was the first of the two to be launched and placed in commission, we will describe the outstanding features of this particular vessel. How suggestive of speed and power are the long graceful lines and short funnels of this liner may be appreciated from the illustration opposite.



Courtesy [*R.M.S.P.Co.*

First-Class Social Hall

The "*Asturias*" has an overall length of 655 ft. 8 in. and is of 78 ft. beam, while her depth is 45 ft. Her gross tonnage amounts to 22,071, as against the "*Gripsholm's*" 17,716 tons. The stumpy buff funnels that dominate the boat deck are oval in section and are 31 ft. in depth and 22 ft. 6 in. in width. Their tops are only 37 ft. above the boat deck. From the keel to the funnel top is about 112 ft. for the forward funnel and 111½ ft. for the aft one.

The vessel is designed to carry a total of 1,800 passengers and crew. The passenger accommodation is particularly luxurious. An original scheme of decoration has been carried out in the first-class public rooms, each being made suggestive of typical "period" styles of the great mansions of many countries. The first-class dining saloon on "A" deck is 94 ft. in length and extends over the whole width of the ship, the central portion, 60 ft. by 40 ft., rising through two decks to a height of 17 ft. The decorative treatment is in the style of the French Empire, the furniture being of dark mahogany with brass inlay. Over 400 passengers can be seated in this saloon.



Courtesy [*R.M.S.P.Co.*

A view of the First-Class Lounge

The reading and writing room, painted in white and having tall Venetian windows, follows Robert Adam's work at Harewood, Yorkshire, while the smoking room is in the William and Mary period, with cedarwood panelling after the rooms in Belton House, Lincolnshire. The magnificent staircases, correctly placed for free movement of the passengers to the various parts of the ship, give easy access to all the important rooms.

Among other interesting features of the ship are a magnificent swimming pool, modelled in the Pompeian style and measuring 29 ft. by 11 ft.; a children's playroom, the walls of which are decorated with scenes from "*Cinderella*" and "*Treasure Island*," and which contains everything to delight the hearts of youngsters; a dark room for photographers and a spacious gymnasium equipped with electrically-driven exercising machines. The ship's news bulletins, etc. are produced by a letterpress printing machine installed on the vessel.

Eleven watertight

bulkheads divide the vessel into 12 compartments, and where these are pierced watertight doors are fitted, these being electrically controlled from the bridge. The latest type of electro-hydraulic steering gear has been installed and the equipment for warping the vessel in and out of docks, etc., includes one warping winch, a 136 h.p. windlass and two capstans.

Electricity may be said to reign supreme on the *"Asturias."* Seven electric lifts and hoists convey passengers, crew and goods from deck to deck, and the lighting and heating are entirely electric. The electrically driven cooking plant is particularly elaborate. In addition to five large ranges in the different galleys and two ovens for the bakeries, it includes grills, fish friers, toasters, bacon-cutting and mincing machines innumerable in addition to such appliances as plate washers, etc. Over 4,000 lamps are in use on the ship. Nearly 500 large electric heaters are distributed throughout the accommodation, each heater being separately controlled so that the temperature can be regulated as required.

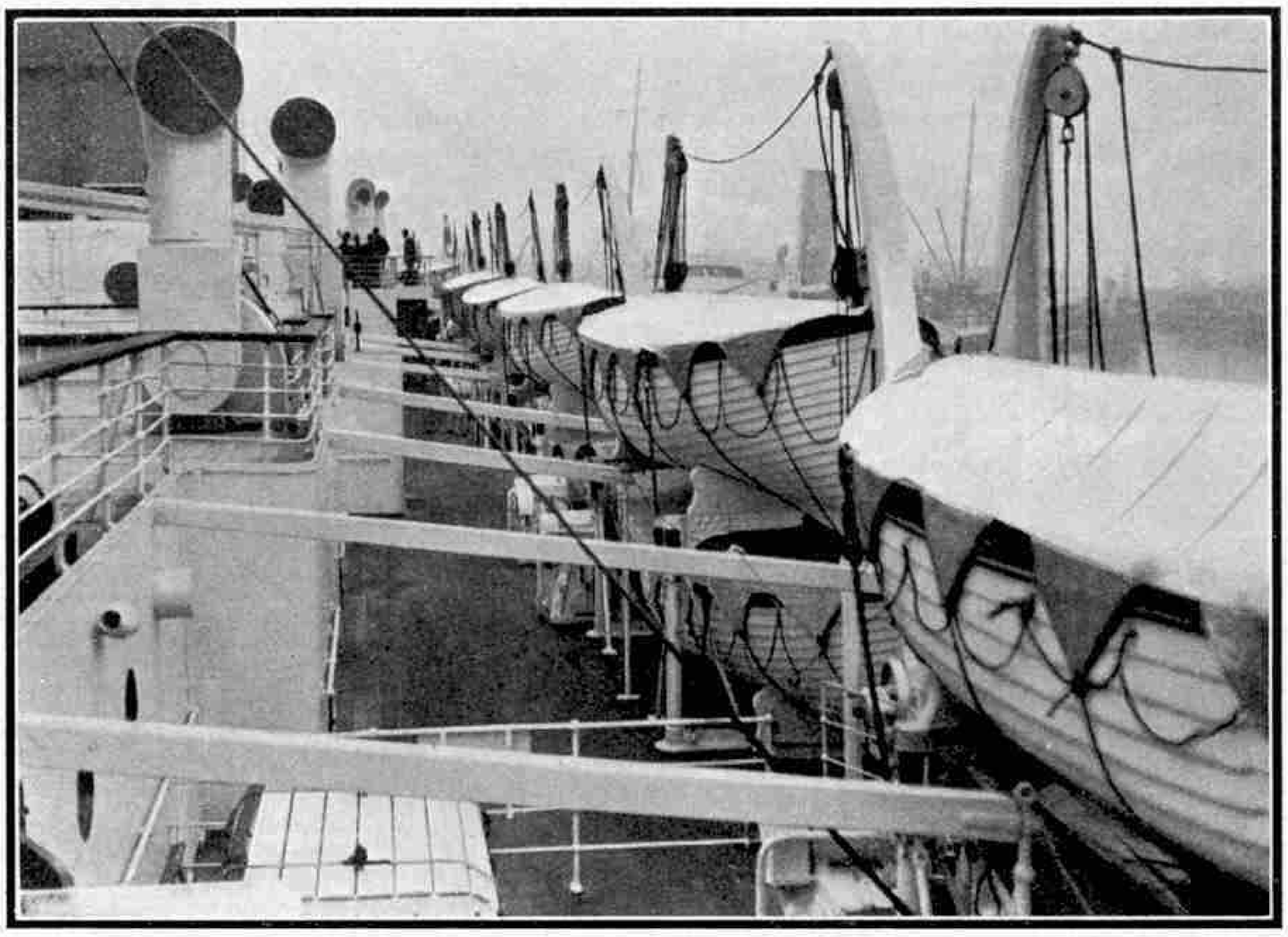
The ship is provided with one of the most complete wireless installations carried by any vessel afloat. In addition, two of the lifeboats have been equipped with Marconi wireless apparatus, power for the transmitters being obtained from petrol-driven generators on board.

A special system of ventilation has been adopted and this is carried out by some 50 large fans installed where necessary to provide an ample supply of cool, clean air in addition to over 450 smaller fans in the state rooms and public rooms for local ventilation.

The *"Asturias"* is equipped with two Harland-Burmeister and Wain four-cycle eight-cylinder double-acting Diesel engines. These engines each develop a total of 20,500 I.H.P. (15,000 brake h.p.) when running at the normal speed of 115 revolutions per minute. A feature of the installation is that the power developed is transmitted to two shafts, thus enabling the usual twin screw arrangement to be adhered to. Each of the 16 cylinders is 33 in. diameter, with a piston stroke of 59 in.

The effect of the double-acting cycle is to give the crankshaft of each engine eight impulses in every revolution, thus providing a very even turning moment. This effect could only be obtained otherwise by adopting the two-stroke cycle. An even turning moment means, of course, less wear and increased life for many important parts, such as crankshaft bearings, big ends and crosshead guides. The engines have forced lubrication throughout and cooling of the great cylinders and cylinder covers is effected by pumping fresh water around them. The pistons are cooled with lubricating oil, which in turn is cooled after circulating by being passed through ingenious vertical sea-water-cooled oil-coolers, of which each engine has three. Six centrifugal separators are provided for the purification of lubricating oil and fuel oil. After the lubricating oil has been employed in the engines, these machines separate out any water or impurity and render the oil usable again.

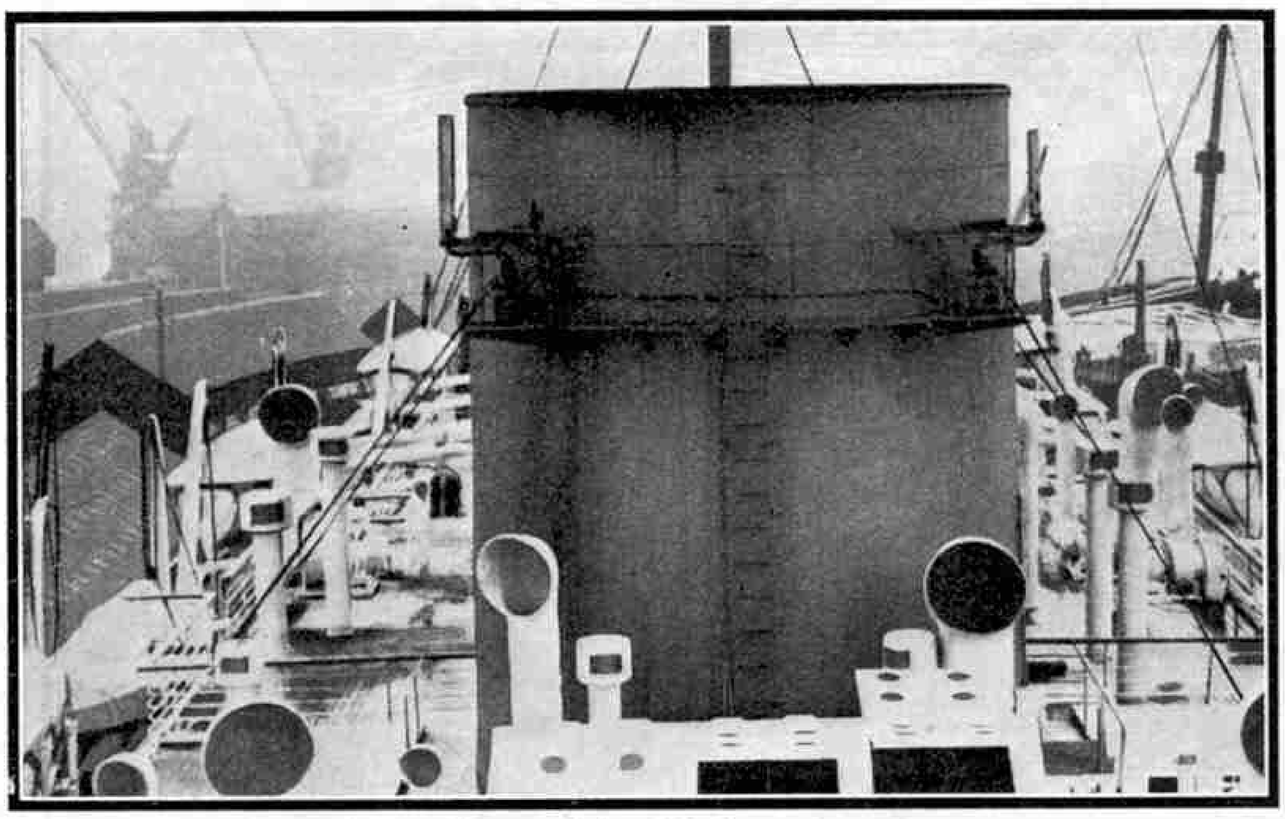
Compressed air for fuel injection is provided from three-stage air compressors, mounted in tandem at the forward end of each engine and driven off an extension of the crankshaft. Manœuvring air at 25 atmospheres is stored in six steel reservoirs, the latter being charged by three two-stage air compressors each driven by a 180 b.h.p. motor. A small steam-driven compressor has been installed for emergency purposes.



Boat Deck, Port Side, of the M.V. "*Asturias*"

Small platforms are provided at intervals between the cylinders of each engine to facilitate inspection of the valve gear, and there is also a top platform, common to both engines, the space between these being bridged by a grating. Plenty of room is allowed for movement in overhauling the engines and removing any of the valves. Four 10-ton electric cranes mounted on overhead runways are provided, one pair to each engine for use in removing the valves or other parts of the engines. Movement of the cranes is controlled from a station at the centre of the top platform.

There are two engine rooms, one housing the main engines and the other the auxiliaries. The numerous cranes on deck derive hydraulic power from pumps in the auxiliary engine room, each driven by a 138 b.h.p. motor. For the compressors in connection with the two refrigerating machines the requisite motors are of 110 h.p. All the engine room auxiliaries are of the latest type and driven by independent electric motors. It is not surprising, therefore, to learn that the total number of motors exceeds 130!



View of the Aft Funnel

Power is supplied to the comprehensive electrical installation of the *"Asturias"* by four generators each driven by a four-cylinder Diesel engine running at 185 revs. per minute, and supplying 1,600 k.w. In addition, there ia a 75 k.w. emergency dynamo placed above the margin line and which can supply the lighting and power for all essential services if required.

The *"Asturias"* was launched on 7th July, 1925, and her official trials took place outside Belfast Loch on 6th February, 1926. During a 48 hours' run progressive trials at increased speeds up to 122 engine revolutions were made, and at this figure an output considerably above 23,000 I.H.P. was registered. Fuel consumption proved to be at approximately 70 tons per 24 hr. day, at full working. The main and auxiliary engines functioned perfectly and the results of the test were considered most satisfactory. The trials provided an endurance test equivalent to a voyage of about 1,400 miles, and when the engines were opened up, at the conclusion of their ordeal, they were found to be in excellent order. Similar gratifying results were obtained at the subsequent trials of the *"Alcantara,"* and in (*Continued on page* 887)

Results of Meccano Model-Building Contests

By Frank Hornby

"May" Competition, Home Sections

MANY interesting models were submitted in the Home Sections of this Competition. The names of the prize-winners are as follows:—

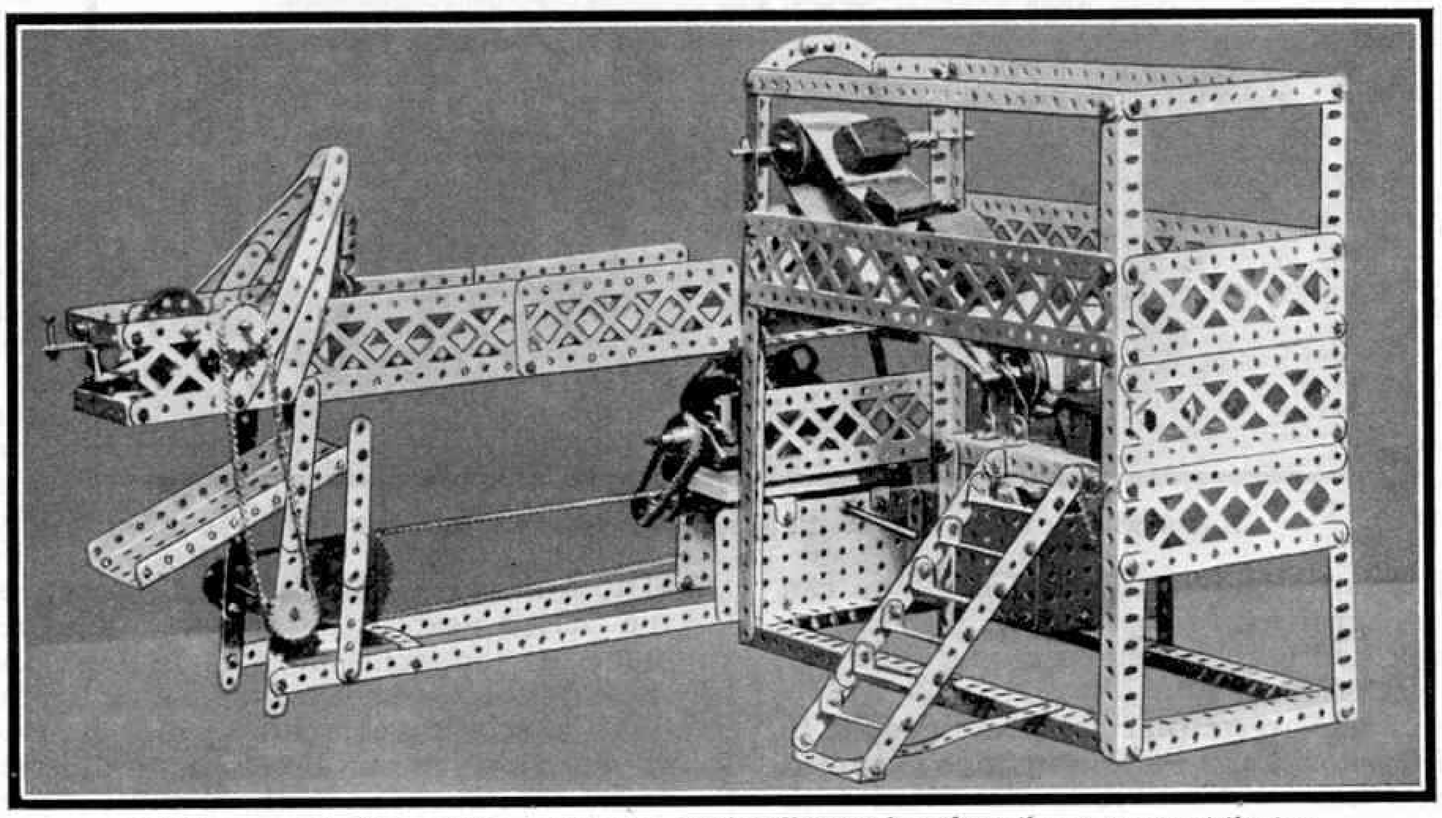
Section A (for competitors over 14 years of age).

FIRST PRIZE (cheque value £3-3s.): E. W. Baker, Frinton-on-Sea, Essex. SECOND PRIZE (cheque value £2-2s.): C. Playford, Uxbridge, Middlesex. THIRD PRIZE (cheque value £1-1s.): P. Banks, Dunstable.

SIX PRIZES, each consisting of Meccano Double Headphones: A. T. Locke, Stratford-on-Avon; Malcolm C. C. Melville, Coventry; T. Mying, Aldridge; K. Fairbairn, Ryton-on-Tyne; N. Batchelor, Westcliff-on-Sea; R. G. Chappell, Manchester.

TWELVE PRIZES, each consisting of Meccano Single Telephone Receivers: A. Gurney, Kirby Muxloe; V. J. Ruxton, Kirkcaldy; J. Savage, Belfast; F. Truslow, London, E.16; W. G. Hammill, Glasgow; J. M. S. Risk, Glasgow; M. Badams, Defford, Nr. Worcester; J. C. Collins, Doncaster; L. Lacey, St. Leonards-on-Sea; Frank March, Ramsey, I.O.M.; C. Jenkins, London, S.W.6; B. Unné, Harrogate.

SPECIALLY COMMENDED (Certificate of Merit and Standard Mechanism Manual): T. Howes, Hull; R. J. S. Barker, Bristol; F. Heaslip, Bath; E. Farndon, Rugby.



Belt Conveyor, by R. Rawkins. Note the merchandise passing along the conveyor at the top

Section B (for competitors under 14 years of age).

FIRST PRIZE (Meccano products to value £2-2s.): R. Rawkins, London, W.7; SECOND PRIZE (Meccano products to value £1-1s.): F. R. Higgs, Leicester. THIRD PRIZE (Meccano Double Headphones): H. Tappenden, Birmingham.

SIX PRIZES, each consisting of Meccano Single Telephone Receivers: P. Jones, London, N.19; W. Baker, Swindon; J. W. Cheesbrough, Thorne; F. L. Bottomley, Huddersfield; G. H. Thorndike, Manchester; W. Banks, New Barnet.

TWELVE PRIZES (each consisting of Meccano Complete Instructions Manuals): D. Paterson, Liverpool; E. A. Durose, Luton; A. H. Norris, Newcastle-on-Tyne; D. A. Theedom, S. Farnborough; E. Whitmore, Rusthall, near Tunbridge Wells; W. Jeffries, Withington; A. D. Gravely, Wellingborough; K. T. Mercer, Paignton; J. H. Downing, Bromhall, Cheshire; T. Chatfield, West Worthing; S. D. Beaumont, Addlestone; C. C. Kenred-Smith, Stroud, Glos.

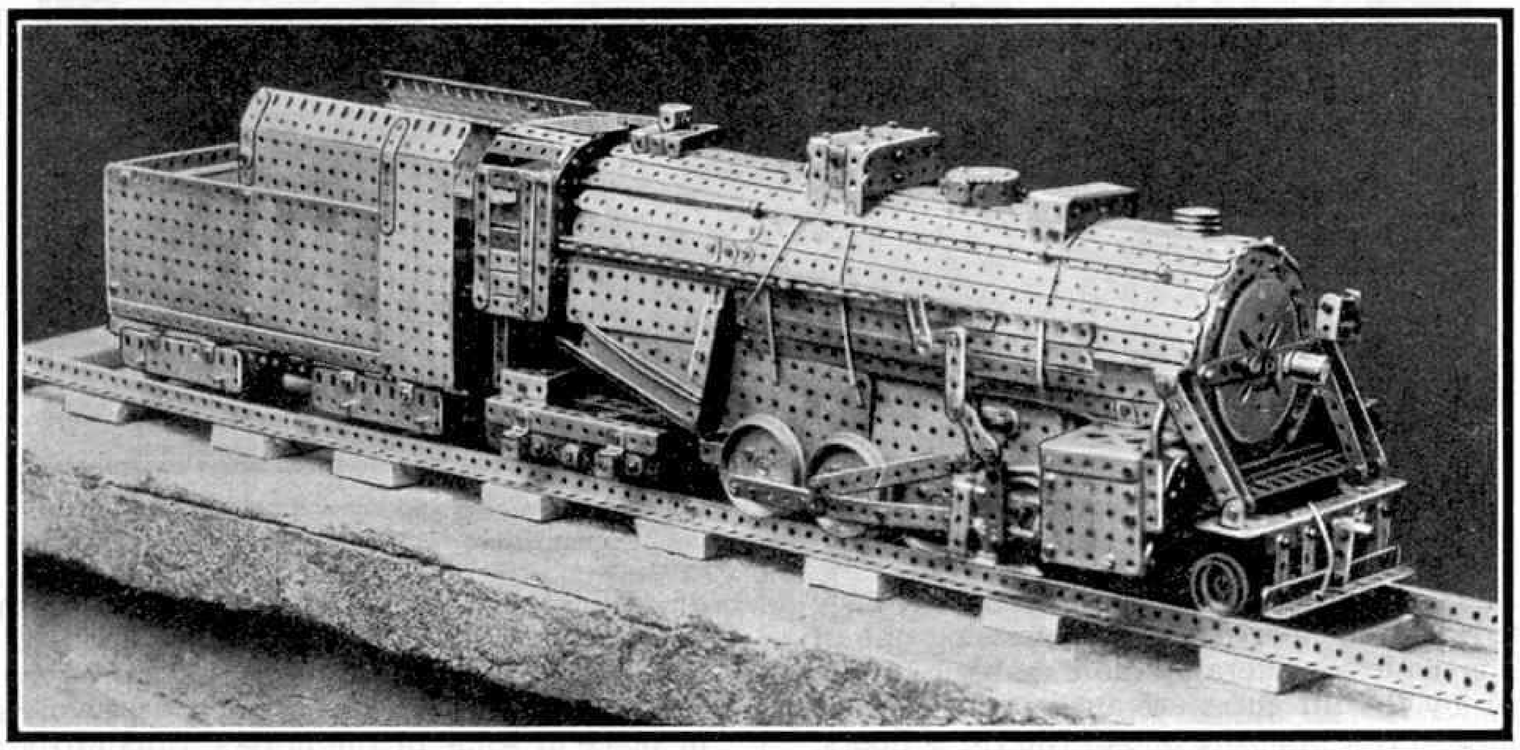
SPECIALLY COMMENDED (Certificates of Merit and Standard Mechanisms Manual): A. Garson, Edinburgh; J. D. Bolton, Cheltenham; J. Bruxner-Randall, Andoversford, Cheltenham.

Readers will doubtless be attracted by the pleasing and realistic appearance of the American locomotive built by E. W. Baker and illustrated at the foot of this page. The model represents a 2–8–4 engine in use on the Boston and Albany Railways, U.S.A. To compare the model with the original readers should turn to page 282 of the April "*M.M.*," where this type of engine is fully described.

The actual locomotive is fitted with an auxiliary engine or "booster" with which the total tractive effort may be increased temporarily when required. This assistance enables the engine to set a very heavy train in motion without the aid of a secondary locomotive, or to haul heavy loads up steep gradients. The booster consists of separate cylinders incorporated in the trailing bogie and acting upon the bogie axles through reduction gearing.

An interesting feature of the model is the electrically-operated warning bell. The bell itself, which is represented by a ¾" Contrate Wheel, is pulled backward and forward by means of a solenoid excited by the accumulator fitted in the massive tender. The model is driven by a 4-volt Motor hidden beneath the boiler, the necessary current being supplied also by the accumulator, so that the model may move under its own power. It should afford a very impressive sight when slowly travelling along the rails! The building of models of American locomotives is perhaps a more difficult task than that of reproducing miniature engines of the type commonly seen in the British Isles, and I think this clever reproduction is therefore worthy of special praise.

Another fine model entered in Section A was the orrery built by C. Playford, and which secured Second Prize. "*M.M.*" readers will remember that a Meccano orrery has already been devised in Meccano (see May, 1927, "*M.M.*" and the 1928 Meccano Book of New Models), but Playford's model is quite different from this. He has attempted to devise an orrery that reproduces the relative movements of the sun, earth and moon as accurately as possible, and his main improvement was to arrange the earth so that instead of the north pole always pointing towards the sun, as in the earlier model, this portion of the planet converges toward the sun only during half the period occupied by the earth in travelling round the sun. The constantly varying tilt of the earth so obtained clearly explains the phenomena of the changing seasons. The complete orrery forms an interesting and instructive model.



A particularly fine example of model locomotive building by E. W. Baker. A 2–8–4 Booster-fitted Locomotive of the Boston and Albany Railroad

"April" Competition, "Overseas" Section

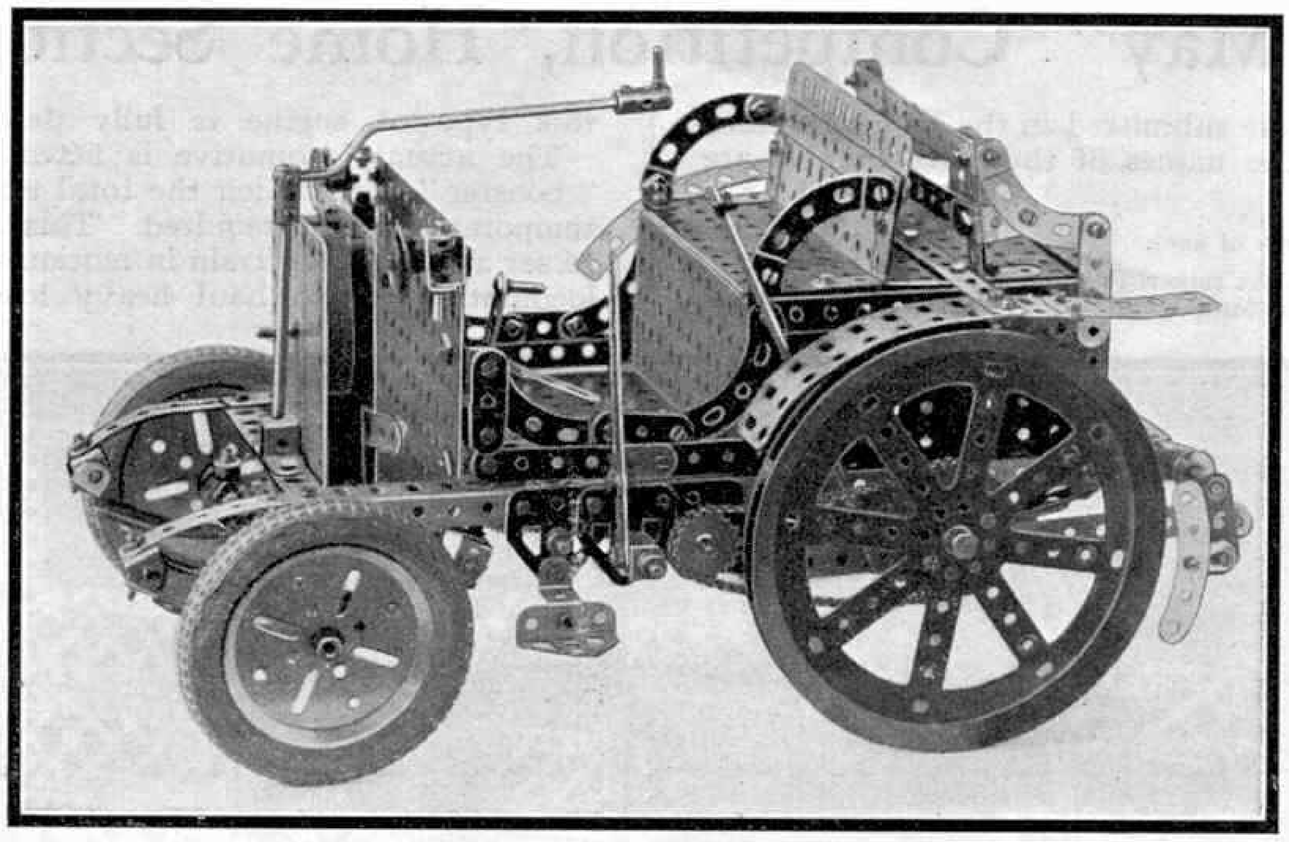
This section of the April Contest was productive of some particularly fine models. The following is a list of the successful entrants:—

FIRST PRIZE (Cheque value £3-3s.): W. Ryan, North Fitzroy, Melbourne, Australia.
SECOND PRIZE (cheque value £2-2s.): R. Wallace, Durban, Natal, S. Africa.
THIRD PRIZE (cheque value £1-1s.): N. B. Scott, Winnipeg, Manitoba, Canada.

SIX PRIZES, each of Meccano Products to value 10/6: A. E. Bull, Singleton, New South Wales; Ian L. Taylor, Hawera, New Zealand; A. Thiele, Odense, Denmark; Lim Cheng Yan, Singapore; K. Muchlig, Ann Arbor, U.S.A.; E. R. Johnson, Glen Iris, Melbourne, Australia.

TWELVE PRIZES, each consisting of Meccano Products to the value of 4/6: Marcel Pauwels, Antwerp; G. Pocci, Rome, Italy; R. Jacob, Calcutta, India; G. T. Curmi, Valletta, Malta; M. Pierre, Strasbourg, A.L., France; J. Mercier, Rouen, S.I., France; W. Bruce Carswell, Invercargill, New Zealand; J. and H. P. Haile, Tiger Kloof, near Vryburg, S. Africa; D. A. Espolet, Barcelona, Spain; M. Celda Balboa, Madrid, Spain; P. F. Woodman, Tenerife, Canary Islands; J. G. Muller, Valletta, Malta.

SPECIAL COMMENDATION (Certificate of Merit and Standard Mechanisms Manual): E. A. Noé, Balcarce, Argentine; J. Sharpley, Hastings, New Zealand; W. K. Bettesworth, Camp's Bay, S. Africa; R. Shepherd, Brakpan, Transvaal, S. Africa; P. N. Hastings, Madrid, Spain.



A Link with the Past: N. B. Scott's prize-winning model of an 1894 P. and L. car

The Meccano model-builder may generally be relied upon to possess that very desirable quality of perseverance that induces him to work steadily on a model until he is satisfied that it is as nearly perfect as he can make it. I was nevertheless surprised to see what a tremendous amount of time and patience had been expended in the construction of W. Ryan's model workshop.

The model, which is one of the largest that has been brought to my notice of late, is over 3 ft. square and its construction occupied four months of the builder's time. The workshop is fitted with every possible detail and is a remarkable example of clever design and construction. In it are to be found nine machines, all of which form in themselves quite large models. Some of these machines, such as a lathe and a vertical saw, have been based on models shown in the Manuals of Instructions, but the others have been constructed to Ryan's own design.

The workshop is adequately lit by a number of small electric lamps and all machinery is run from overhead shafting, the shafting being driven by a large electric motor situated in the upper portion of the workshop. Also included in the model is an ingenious switchboard whereby the motors and lights are controlled. Unfortunately it is impossible to illustrate the complete model but it will be understood that it forms a very impressive structure.

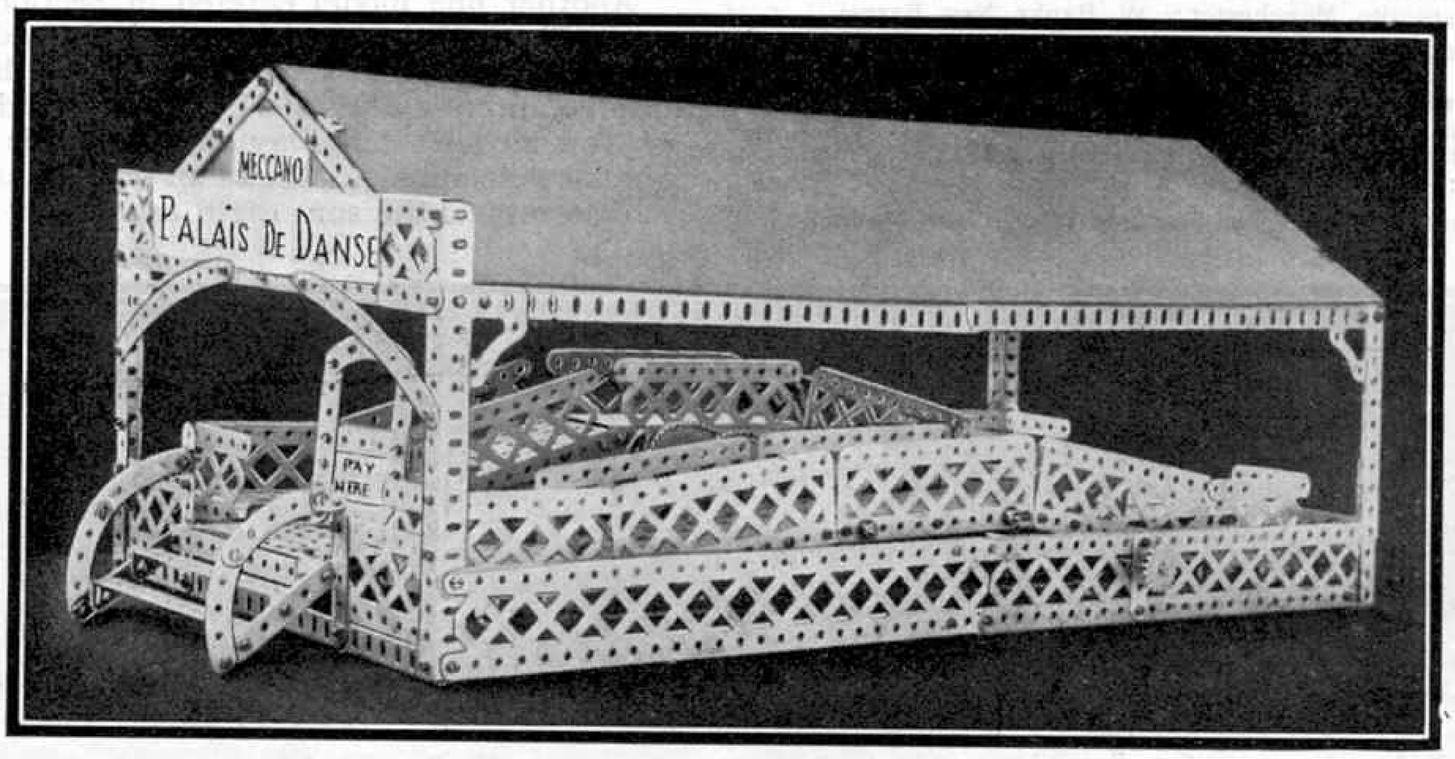
One of the most ingenious entries in this Section was the "Push Button Lift" that carried off the Second Prize for R. Wallace. The lift is controlled, as its title implies, by means of a number of push buttons, the cage being stopped and started at each floor merely by pressing one of the buttons. The model is made considerably more realistic by the addition of a device whereby the lift gates are automatically kept closed until the cage comes to rest opposite one of the three floors. It is operated entirely by electricity, the push button mechanism consisting of a number of magnetic-solonoid relays that cause the current to the Motor to be switched off or on automatically when the cage is opposite one of the platforms.

The most attractive features of the lift is naturally the electrical mechanism, but I was particularly struck by the detail and careful constructional work displayed in the building of the framework, etc. This model certainly shows Wallace to be a Meccano engineer of considerable merit, and I feel sure that many readers, having read this short description of the model, will be anxious to gain fuller particulars of it. I hope therefore that it will be possible to publish in the near future full details that will enable any Meccano boy to construct the lift for himself.

Enthusiastic readers of the series of articles on "The Story of the Motor Car" will be interested in the model of an old-fashioned Panhard and Levassor car constructed by N. B. Scott and illustrated on this page. The car, which has been modelled on an illustration that appeared in the February *"M.M."* includes a Clockwork Motor mounted on the front of the chassis, by means of which the vehicle can be driven forward. The chassis also includes a two-speed gearbox, the gear change being effected by moving a $5\frac{1}{2}$" Strip from side to side (the Strip may be seen pivoted to the side of the chassis nearest the camera). Further realism is added to the model by the inclusion of chain drive and "tiller" steering, both these obsolete mechanisms being features of the original car.

An interesting comparison may be made by placing the photograph of Scott's car alongside an illustration of the new Meccano motor chassis. The Panhard and Levassor car on which the model was based was built about 1894, whilst the motor chassis can be said to be representative of the latest developments in motor engineering. The contrast will be tremendous and will give the reader some idea of the way in which the petrol-driven vehicle has developed in the last thirty years.

Bert Hinkler's historic flight from England to Australia will still be fresh in the minds of many Meccano boys and the model of his Avro-Avian light aeroplane, constructed by E. R. Johnson, is therefore specially interesting. Its constructor, although only nine years of age, has succeeded in devising a most realistic model of the famous plane, although I doubt whether Mr. Hinkler would be pleased at being represented in the model by means of a 1" loose Pulley and three $2\frac{1}{2}$" Strips!



A. T. Locke's model is labelled "Palais de Danse," but we think Meccano boys will know it better as a "Cake Walk." (From the "May" Competition)

Amongst many other interesting models I noticed a particularly clever Merry-go-round built by K. Muchlig. Its builder has christened his model "Horses, Horses, Horses," as a number of small horses have been included on the rotating platform of the model. When driven by an Electric Motor the model must look very effective, although an improvement could be made by substituting other objects such as revolving cars, gondolas, etc., in place of some of the horses, thus introducing still more variety and movement.

"June" Competition, Home Sections

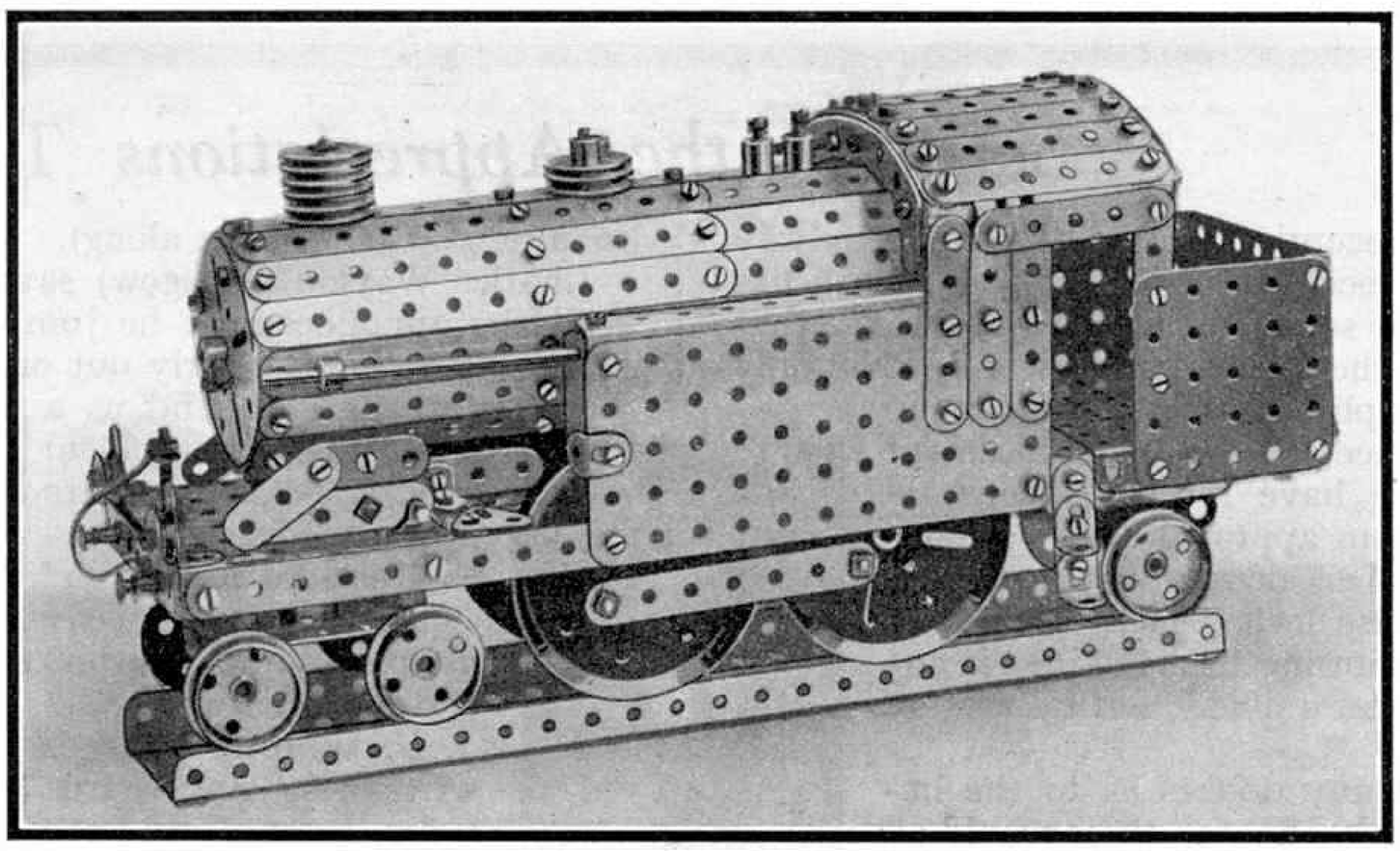
THE principal prize-winners in the Home Sections of the Model-building Competition that was announced in the June, 1928, "*M.M.*" are as follows:—

Section A (for competitors over 14 years of age)

FIRST PRIZE (cheque value £3-3s.): Ronald Artingstall, Stratford, Manchester. SECOND PRIZE (cheque value £2-2s.): A. M. Johnston, Dunstable, Beds. THIRD PRIZE (cheque value £1-1s.): E. Whalley, Blackburn.

SIX PRIZES, each consisting of Meccano Double Headphones or Meccano Crystal Receiving Sets: H. Clements, Luton, Beds.; H. Masse, Crawley, Sussex; A. L. Macon, Old Trafford, Manchester; C. Swann, Manchester; R. Hannah, Dorchester; B. E. Crofts, Bristol.

TWELVE PRIZES, each consisting of Meccano Single Telephone Receivers: M. Vaughan Jackson, Berkhamstead; James Shapley, Exmouth; A. T. Field, London, N.4; D. MacDougall, Kinlochleven, Argyll; L. Lacey, St. Leonards-on-Sea; H. Hancock, Pinner; R. W. Rush, Accrington; L. E. Cobb, Westcliff-on-Sea; K. Bradford, Bristol; S. Goodson, Sherwood, Nottingham; F. W. G. Freeman, London, S.W.18; A. Kitto, Fearnside.



A neat model 4–4–2 Tank Locomotive, constructed by E. P. Rudkin

SPECIALLY COMMENDED (Certificates of Merit and Standard Mechanisms Manual) Lyn Holman, Camborne, Cornwall; G. K. Hooper, Wallasey; J. E. Gibson, Horsforth, near Leeds; B. Giebemainn, Hampton, Middlesex; J. C. Collings, Goldthorpe, Near Rotherham; J. Stewardson, Barnard Castle, Co. Durham; C. E. Wrayford, Teigngrace.

Section B (for competitors under 14 years of age)

FIRST PRIZE (Meccano products to value £2-2s.): E. P. Rudkin, Grantham, Lincs. SECOND PRIZE (Meccano products to value £1-1s.): W. H. Crowhurst, Surbiton. THIRD PRIZE (Meccano Double Headphones or Crystal Receiver): S. G. Hough, Melton Mowbray).

SIX PRIZES, each consisting of Meccano Single Telephone Receivers: R. Nightingale, Langley; D'Orell Cousens, St. Leonards-on-Sea; D. G. R. Davies, Keighley; G. P. Neilan, New Seaham, S.O., Co. Durham; W. A. Lavers, St. Leonards-on-Sea; W. R. Innes, London, S.W.16.

TWELVE PRIZES, each consisting of Meccano Complete Instruction Manuals: A. B. Currie, Leith; R. G. Musgreave, Heath, Near Wakefield; S. King, Birmingham; R. Darke, Birmingham; J. Thexton, near Chesterfield; B. G. D. Salt, Shrewsbury; F. A. Bagg, London, N.12; J. B. Crossland, Lancaster; R. H. A. Liston, Southsea; P. A. Farrant, Sutton; E. Brian Bell, Lancaster; E. Pooley, Bekesbourne; E. Cropper, Manchester; K. G. Harland, Leigh-on-Sea.

SPECIALLY COMMENDED (Certificate of Merit and Standard Mechanisms Manuals): R. Lee, Birkenhead; A. W. Midmer, London, S.W.16; A. W. Jones, Littlehampton; J. Vyse, Norwich; K. Hall, Birmingham; D. Cain, London; M. Lacey, Eastbourne.

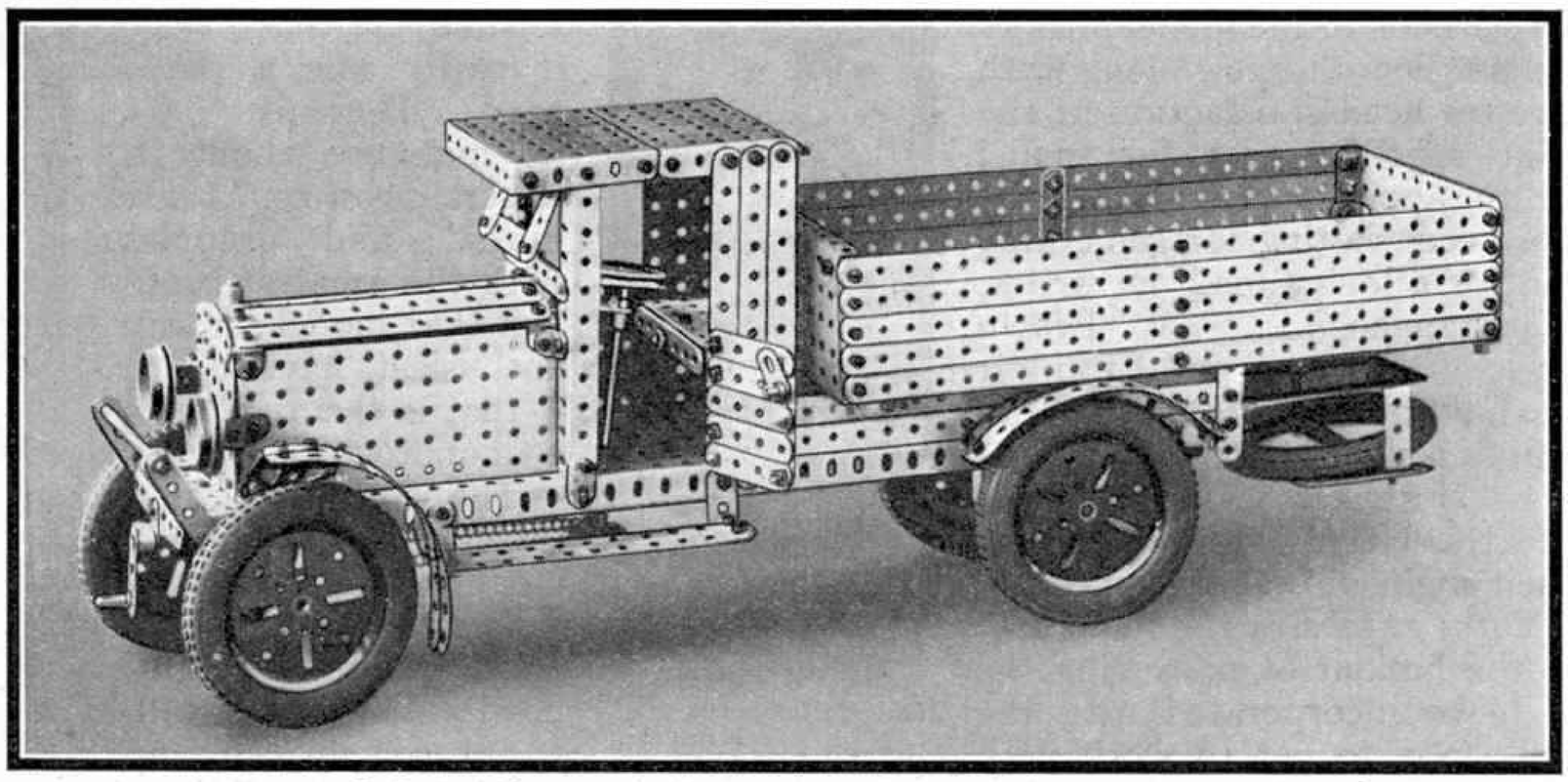
During recent years some really remarkable models have been brought to my attention, but it is rarely that such a large and complicated mechanism as a cinematograph is entered in a model-building contest. R. Artingstall has succeeded in building a practical working model of one of these machines, however. Although recently several different types of home cinematograph machines of extremely simple outward appearance have been placed on the market, it should not be thought that the mechanism of the cinematograph is at all simple. Any reader who has taken a peep into the operator's box in a cinema will know that the film projector is far from simple in design!

Artingstall's machine incorporates the usual "feed" and "take-up" mechanism to be found in an orthodox projector, and also includes a "shutter." Meccano boys interested in cinematography will know that the film is moved across the "gate," or lens opening, intermittently, and not in one continuous run, and in order, therefore, to prevent the spectators from seeing the film moving on the screen, a semi-circular shutter is interposed between the source of light and the film and rotated so that the film is only seen on the screen when it is stationary in the "gate."

It is obvious that a considerable amount of ingenuity was needed in order to cause the "shutter" in the model to work in unison with the "feed" mechanism.

An interesting coincidence that was of great assistance in building the model is the fact that the teeth of the Meccano Sprocket Wheels fit into the perforations of the standard film. These wheels were therefore used in the construction of the feed mechanism. It is also interesting to note that, with the exception of a magnifying lens and, of course, the lantern, the mechanism was constructed entirely from Meccano parts.

No less interesting was the model of George Stephenson's "Rocket" constructed by A. M. Johnston. The model is built to scale and is a very creditable reproduction of the "Father of the Iron Horse." Johnston has added further interest to this excellent model by fitting a penny-in-the-slot mechanism to it so that whenever a coin is dropped into a slot in the base on which the model is mounted, the wheels of the locomotive revolve for a short period. Full particulars of the automatic mechanism will be found in this month's "Suggestions Section."



S. G. Hough's prize-winning model of a Commercial Motor Vehicle

The upper illustration on this page is of a 4–4–2 tank locomotive constructed by E. P. Rudkin. Many readers will observe at once that the prototype of this model is the famous L.M.S. 4–4–2 "Precursor" tank engine—a type that may often be seen hauling suburban trains around London and Manchester. The model has a particularly solid and well-built appearance and Rudkin has achieved considerable accuracy of detail without bending or mutilating any of the Meccano parts.

Amongst other interesting entries in Section B of the Contest I was particularly pleased with the design of the motor lorry illustrated on this page. Its builder, S. G. Hough, has certainly proved himself to have a good knowledge of automobiles and also of correct model-building practice. Points that give the model "that real look" are the spare-tyre carrier, the front bumper, and its general well-proportioned outline. A very simple but efficient steering gear is incorporated.





Some of the Appreciations That Have Reache

THE enthusiastic reception that the Hornby Railway Company has received during the past month has shown that the scheme is filling a great gap that previously existed in the model railway world. Not only have hundreds of applications for membership arrived every day since the first announcement but, in addition, we have received scores of letters expressing warm approval of the scheme and asking for further details on particular points. Many of these letters have been from "grown-ups," thus showing that the idea is one that appeals to model railway enthusiasts of all ages.

If there had been any doubts as to the immediate success of the "H.R.C." these would all have been swept away by the flood of letters we received on the day following the announcement of the scheme in the October "*M.M.*" Greatly as these letters differed in detail, they all had one thing in common—they said in effect:—"This is the very thing we were waiting for!"

Harold Rigby (Westcliff-on-Sea) writes:—"I think it's one of the best ideas since the Meccano Guild was formed"; Emmanuel DeCottignies (Southend-on-Sea) sends the message: "My chums and I are very eager to get up a local branch of the 'H.R.C.'"; while C. T. Rhys (Salisbury) says the formation of the "H.R.C." is "a most notable occasion in the model railway world." E. D. Cutts (Scunthorpe), along with many others, expresses keen satisfaction at the announcement that special pages for model railway users are to appear regularly in the "*M.M.*" "I have been waiting for something like this to happen for a long time," he writes, "and at last it has happened." S. W. Brown (London, E.15) says: "My friend and I think it is a splendid idea to have a club so that a boy can get 100 per cent. out of his hobby"; and Samuel Leeper (London, E.17) strikes a cheery note: "Here's success to the Hornby Railway Company—and may their engines always be on time!"

Samuel Bruce (York) expresses the hope that his city will have the honour of possessing the first local branch to be incorporated with the "H.R.C." He will have to get to work very quickly if he is to be in time!

The announcement seems to have brought considerable relief to D. MacLeod (Aldershot). "I have seen the announcement in the October '*M.M.*' of the 'H.R.C.,'" he says, "and I consider it a jolly fine idea. Next to my homework, wireless and motorbike, the track for my model railway has been my greatest worry, but now I see a way out!" (We shall be glad to tackle your problems, D.M., as soon as you send them along).

Charles Watson (Glasgow) says that when he read the announcement he jumped for joy and startled the family nearly out of their wits! He threatens to send us a fresh railway problem every week, but we are not in the least dismayed, the more the merrier!

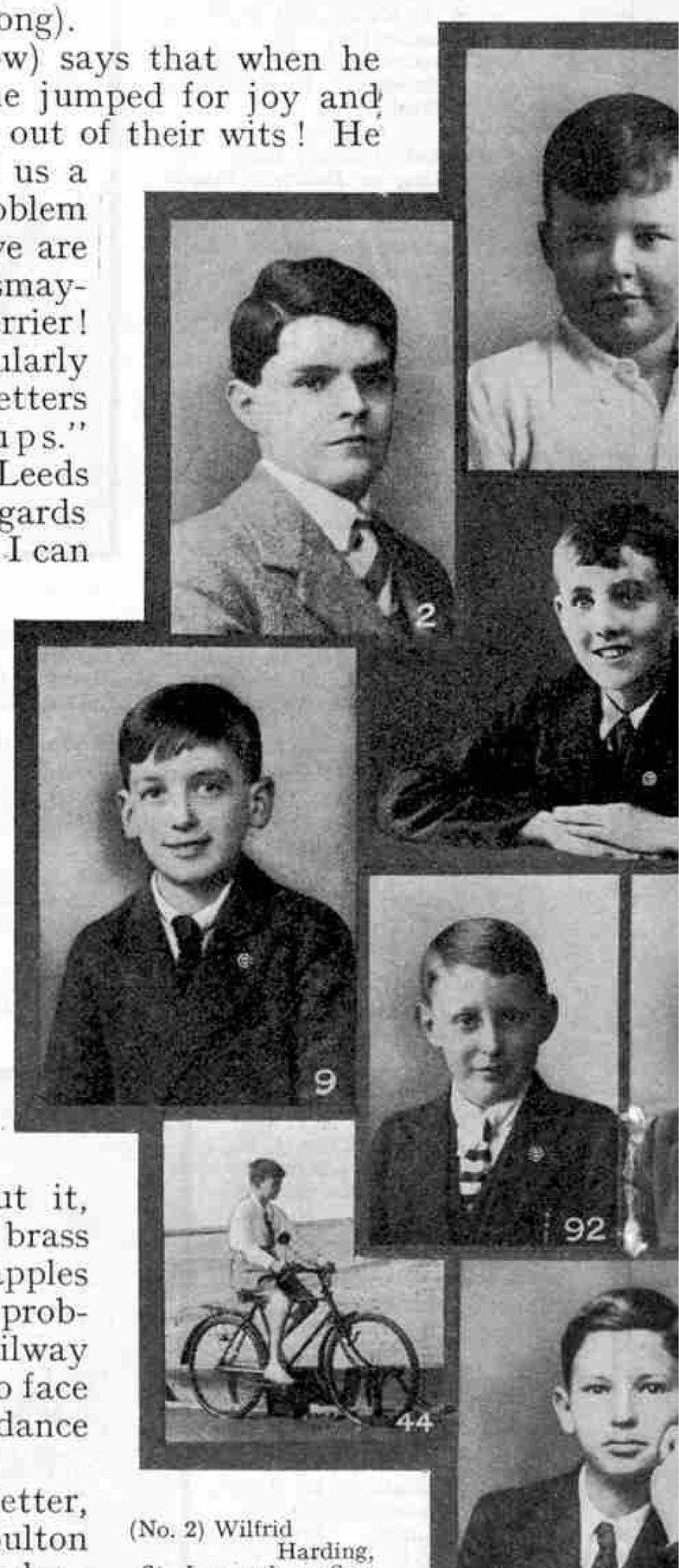
We were particularly interested in two letters from "grown-ups." J. F. Whiting of Leeds writes:—"As regards years, I am afraid I can scarcely be considered a boy; but as regards keenness for miniature railway working I am as young as the youngest. The feature that strikes me most about your Hornby Railway Company scheme is that it really fills a need. There is no nonsense about it, it gets down to 'brass tacks' and grapples with the greatest problem that model railway enthusiasts have to face—that is the avoidance of monotony."

The second letter, from Herbert Poulton of Birmingham, reads:—"Your scheme opens up an entirely new field of possibilities and it will, I am certain, stir up new keenness in all those who have this hobby at heart. I am particularly glad to note that you are not forgetting the beginner, and that you are going to look after his interests, as well as those of the 'old hands.' You may be assured that I shall do my utmost to start a local branch as soon as possible, and I confess that I shall feel just a little bit taller if I attain the



These happy boys were among the first hundred to join the Hornby Railway Company.

(No. 49) T. Pinson, Mansfield.
(No. 54) T. R. Gray, Norwich.
(No. 50) Colin Byrom, Lytham.
(No. 27) W. St. C. Symmers, Belfast.
(No. 19) Noel Marker, Lyme Regis.



(No. 2) Wilfrid Harding, St. Leonards-on-Sea.
(No. 3) D. A. Dale, Bournemouth.
(No. 6) Michael Savage, Reigate Hill.
(No. 9) Cecil Beverley, Dewsbury.
(No. 10) Rowland Bowen, Hampstead.

Here are some first 100 applicant the H. R. C., wi membership numb in the bottom r corner

SUCCESS OF AILWAY COMPANY

RUSH TO JOIN THE NEW MOVEMENT

HORNBY RAILWAY COMPANY

MEMBERS OF THE H.R.C. ARE ENTITLED TO WEAR THIS BADGE, WHICH IS BEAUTIFULLY ENAMELLED IN COLOURS

...ched Us — We Haven't Room for Them All!

honour of permanent Branch Chairman!"

Many of the earliest members to join the "H.R.C." sent us their photographs, and naturally we were intensely interested to see these and to gain an idea of the type of boy who was responding to our scheme. In examining these photographs the thing that impressed us most was the alert keenness of the faces. Without exception these were obviously clean, intelligent boys, with ambition and determination to succeed both in their work and in their play. We feel that the future of the Hornby Railway Company is safe in the keeping of such splendid specimens of British boyhood as these.



(No. 13) Gerald Symonds, Altwood Bailey.
(No. 15) Robert Williams, London, N.W.
(No. 38) Reginald Cox, Balham.
(No. 42) H. C. Mortimer, Leyton.
(No. 44) David Tillett, Maidstone.
(No. 92) Jack Race, Aylesbury.

...e some of the applicants to join ...t. C., with their ...ip numbers shown ...ottom right-hand corner

Every post brings in more applications for membership and although our staff is working at high pressure, we would ask correspondents to be lenient and to excuse us if they don't get a reply by return of post! With all the good will in the world, and even with an augmented staff, it is impossible to cope with the flood of letters and applications with our usual promptitude.

To join the "H.R.C." you should first of all obtain an application form from Headquarters. Fill in this form, have your signature witnessed and return it to Headquarters with 6d. in stamps in payment for the official badge. You will then be enrolled as a member of the "H.R.C." and your badge and your certificate of membership will be forwarded to you. The badge, which is illustrated in the top corners of these pages, is beautifully finished in red and green enamel. It bears a representation of a locomotive and train surrounded by the words "Hornby Railway Company," and is worn in the buttonhole. By means of the badge all members of the "H.R.C." are able to recognise each other when they meet, their badges indicating at once that they have something in common—an interest in railways. After a hearty handshake, conversation never flags between any "Hornby Railway Company" members who may meet in this manner.



Some more happy Hornby Railway Company members.

(No. 25) E. D. Cutts, Bottesford, Lincs.
(No. 20) J. W. Moss, Watford.
(No. 16) A. Bradley, Middlesbrough.
(No. 30) E. Blackwell, Oswestry.
(No. 73) R. G. Stewart, Belmont.

A special booklet has been prepared in connection with the "H.R.C.," which is invaluable to every model railway enthusiast. It deals with the planning, laying out and operating of a miniature railway on real railway-like principles, and shows how to obtain the utmost possible fun and excitement. Timetable working, which is one of the most fascinating branches of the hobby, is specially dealt with and instructions are given that will enable a timetable to be worked out for any layout. A section that will be of special interest to the beginner deals with the care and treatment of locomotives and rolling stock.

The operation of a real railway necessitates the use of certain forms and documents to be filled in by the various officials concerned. Many of these forms are, of course, unsuitable for miniature railway working, but the use of others adds enormously to the fun and excitement of operating the railway. A special selection of five of the most useful forms has been made and miniatures of them have been prepared.

These forms are as follows:—

G.W.1 General Working Timetable.
S.D.4 Stationmaster's Arrivals and Departures.
E.J.5 Engineman's Job Card.
S.B.6 Signal Box Instructions.
S.R.7 Stationmaster's Report Forms.

Each of these forms is made up in pads of 50 which may be obtained by members from Headquarters, price 5d. each, post free. The price of the complete set of five pads is 2/–, post free. Each type of form is printed on a distinctive shade of paper. When ordering separate pads the initials and reference number (to be found in the top right-hand corner of each form) only need be quoted. The use of these forms is fully described in the booklet, and specimens are filled in so as to make matters absolutely simple and clear. When you send in your application for membership of the "H.R.C.," enclose 2d. for a copy of this booklet.

Local Branches of the "H.R.C." are now being formed all over the country, why shouldn't you form one?

How to Get More Fun from your Hornby Railway

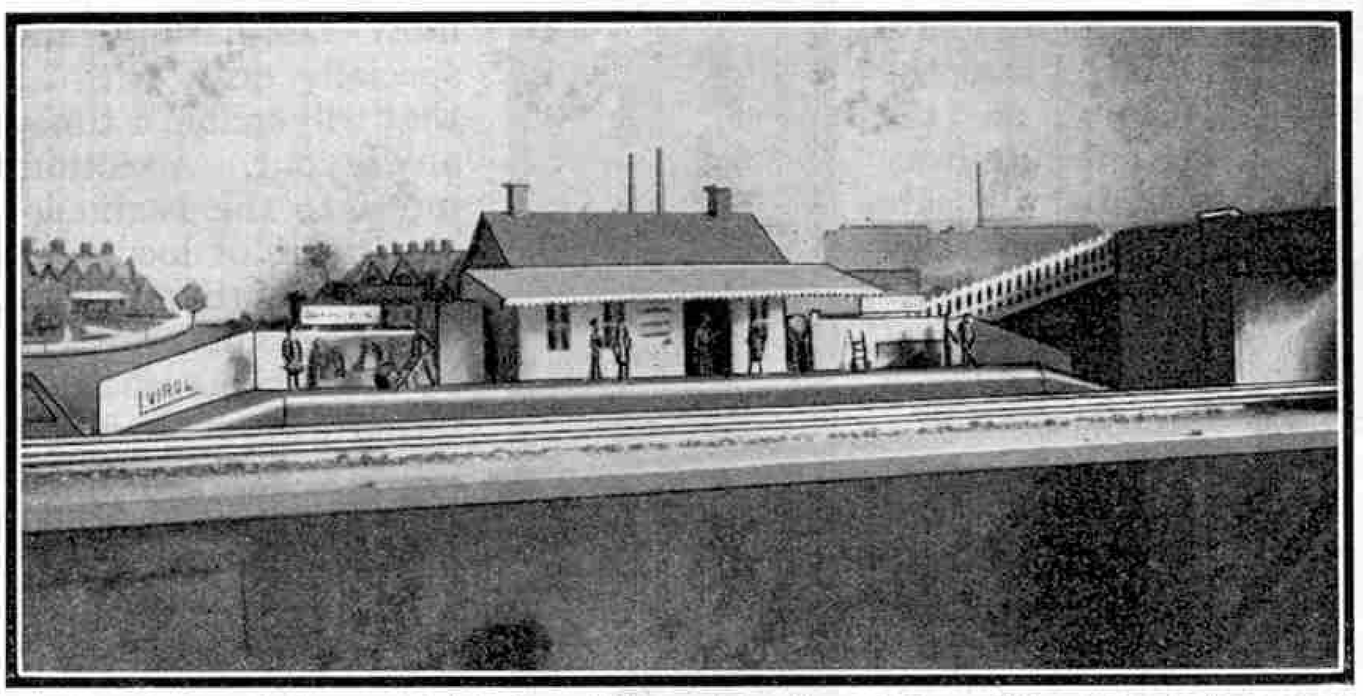
I.—GOODS YARD LAYOUTS AND WORKING

ON many model railways, goods train operation is either ignored altogether or is given a very subsidiary position. This is a mistake, because a great deal of fun and, indeed, excitement, is missed by Hornby enthusiasts who concentrate entirely on passenger working.

When the general plan for a model railway layout and the positions in which the stations are to be placed have been determined, the next consideration should be the provision of a goods marshalling yard. Many model railway users do not attempt to plan a definite goods layout because they are under the impression that, in order to carry out operations of any interest a large amount of space is necessary. This is not the case, however, for although obviously a large space offers greater possibilities than a small one, it is not at all difficult to lay out an interesting goods yard within comparatively narrow limits. The secret of success is careful planning so as to utilise every inch of space to the best advantage, and this in itself is an extremely interesting task.

This article is the first of a series written specially for the benefit of Hornby train owners by a model railway expert of long experience. It is intended to treat one by one the outstanding features of model railway operation in the course of these articles, and also to deal with any interesting problems that may be submitted by readers.

In many cases a goods yard will be found most useful if it is situated near a passenger station, and for this reason it is advisable to have a passenger station close to one of the corners of the room in which the railway is laid out. The goods line then may be run into this corner, and space that otherwise would be wasted can be utilised for shunting and marshalling operations. In arranging the layout, care should be taken to avoid placing any points levers in positions that are awkward to get at quickly, otherwise difficulties will crop up when operations are being carried out in the yard.



Our photograph shows a strikingly realistic model railway station. This station is home-made throughout, and its constructor, C. McLean, of Ayr, N.B., has every reason to be proud of his effort. The houses in the background help to give depth to the whole scene, and the miniature passengers and railway officials on the platform give it life.

The track and points are all of Hornby manufacture, and the owner has ballasted all main lines to ensure absolute steadiness. The bridge on the extreme right of the photograph is also home-made.

The two chief factors that will decide the size of the goods yard are the amount of space available and the amount of traffic that will be handled in that space. If it is possible to arrange for a fairly long run off the main line into a large marshalling yard, a great deal of trouble will be avoided, as shunting engines will not be required to trespass on to the main line during marshalling operations. It is, of course, not always possible to have a long lead into a model goods yard, and in such cases it will be necessary for the engines, when shunting, to back out on to the main road. In order to avoid any accidents on such occasions it is a good plan to have a signal to guard the section. A signal for this purpose could be arranged to work in conjunction with a brake rail, and this arrangement would serve as a safety device preventing the possibility of accidents occurring to locomotives that are shunting trains.

In any case, unless it is entirely unavoidable, the main line should only be interrupted twice at most—once by a pair of points and a crossover giving entrance to the goods yard and, if necessary, again by another set of points providing an exit from the yard.

In order to overcome the difficulty of congesting the main line through having the goods yard very close to it, a good plan is that of laying a single line parallel to the main line, between the exit from the goods yard and the point of junction with the main road. If this plan is adopted it will be possible for engines to take goods trains of considerable length in and out of the sidings without one end obstructing the main line traffic.

If the system is intended to be permanent, one of the greatest advantages gained by the use of this plan of approaching from the main line to a goods yard is that the extra line, being situated close to the station, is extremely useful for coach sidings.

Our illustration shows a suitable layout for use where there is a fairly large amount of space available, such as in the centre of a continuous system around a room. This kind of shunting layout is often adopted by model railway engineers who are particularly keen on shunting operations. Almost any train can be received, sorted, re-assembled and despatched on a goods yard layout of this type.

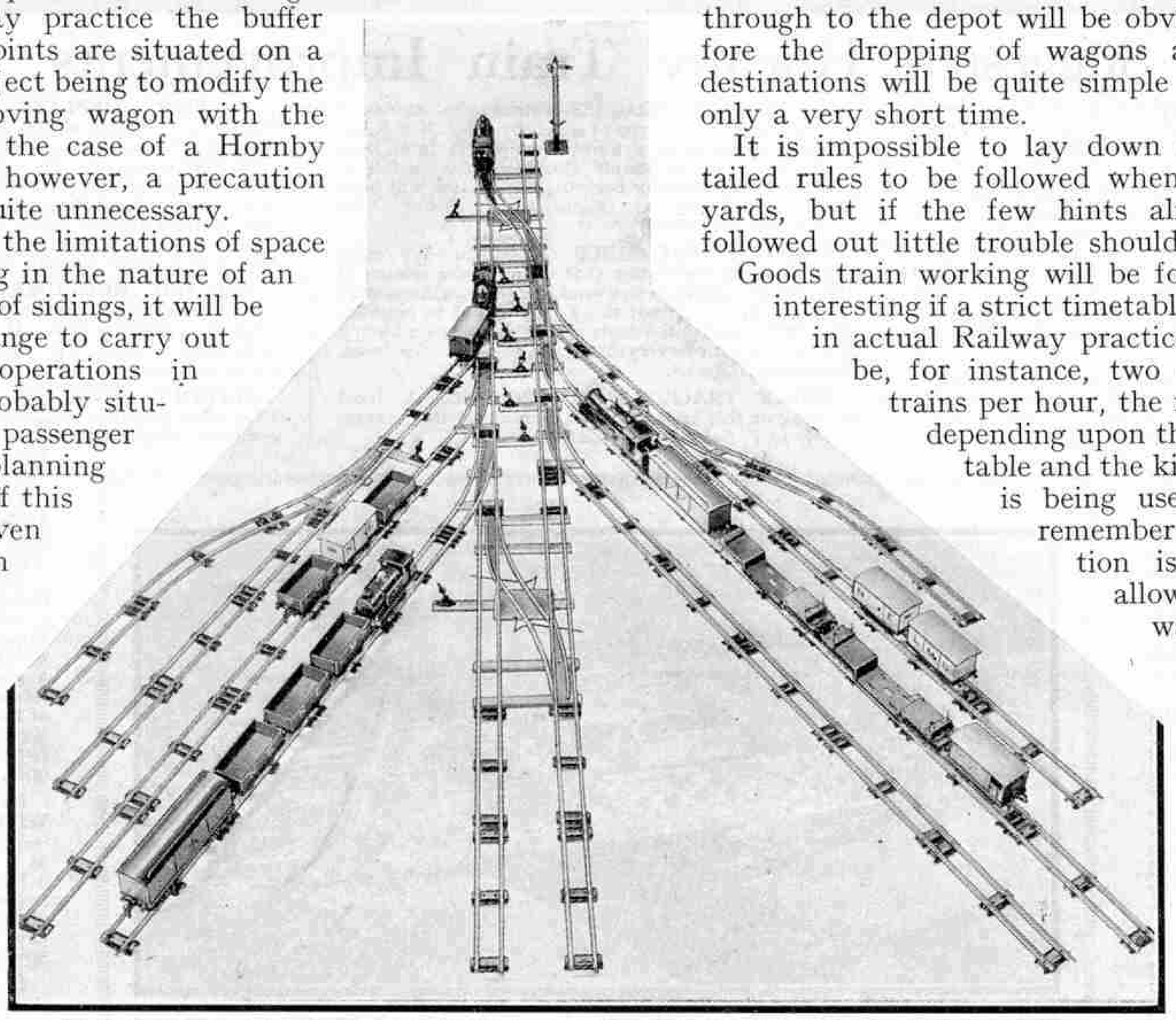
The working of a layout such as this requires careful consideration if the utmost fun is to be obtained from the various operations. For instance, if the engine of an incoming train runs directly into the siding, it will be out of commission until the whole train has been sorted and removed from the track upon which it stands, unless the operators are warned that all trains entering from the main line must continue right on through the yard by means of the two parallel lines towards the dead end,

which is assumed to be the position from which the photograph was taken. A shunting engine should then relieve the train engine and take the train away for re-assembling or unloading, leaving the other engine free to proceed to the sheds or to the turntable to be ready to take over the next out-going train. This precaution will obviate waste of time caused by " trapped " locomotives.

Another point worthy of careful consideration in regard to a model marshalling yard is the gradient. This should be arranged to fall away slightly from the main line wherever possible, and it should terminate at the terminal points of the sidings.

In actual railway practice the buffer stops at these points are situated on a slight rise, the object being to modify the impact of a moving wagon with the buffer stop. In the case of a Hornby Railway layout, however, a precaution of this kind is quite unnecessary.

In cases where the limitations of space prohibit anything in the nature of an extensive layout of sidings, it will be necessary to arrange to carry out the necessary operations in small sidings, probably situated behind the passenger stations. The planning of a small yard of this kind demands even more care than that of a large one in order to make it possible to deal with the maximum amount of traffic in the shortest time. The following points are of great importance and should be carefully considered before commencing to lay out a small shunting yard. A little forethought often saves trouble later.



A typical example of a model railway sorting yard. Where a layout of this kind is used, almost any goods train may be sorted and re-assembled without any difficulty whatsoever.

Readers will be interested to learn that if sufficient space is not available to lay out the whole of the scheme illustrated, the number of sidings may be reduced considerably without seriously affecting the efficiency of the yard.

In the first place, do not place crossovers to lead directly over to within one rail length or so of a buffer stop. Shunting over one line to another by means of a crossover in such a position would inevitably be a long and wasteful operation. The whole train would have to be split up into its component wagons and two locomotives would be required to pass a train from one line to another. In a layout including such a fault as this it would be necessary for one wagon at a time to pass over the crossover. The business of the second locomotive would be simply that of removing the wagon from the buffer stop, thus making room for the next one. It is hardly necessary to emphasise this matter, for it is obvious that, with the crossover arranged in the opposite direction, little or no difficulty is experienced in carrying out similar operations.

Sidings should not be laid running from facing points off the main line into small yards, because in that case the engines of incoming trains would be trapped. Sidings off the main line should be approached by trailing points in order to enable the engine to back the necessary wagons into the sidings and then to proceed. It is for this reason that in many cases in actual railway practice the last wagons of a goods train are destined for the first station to be passed on the route.

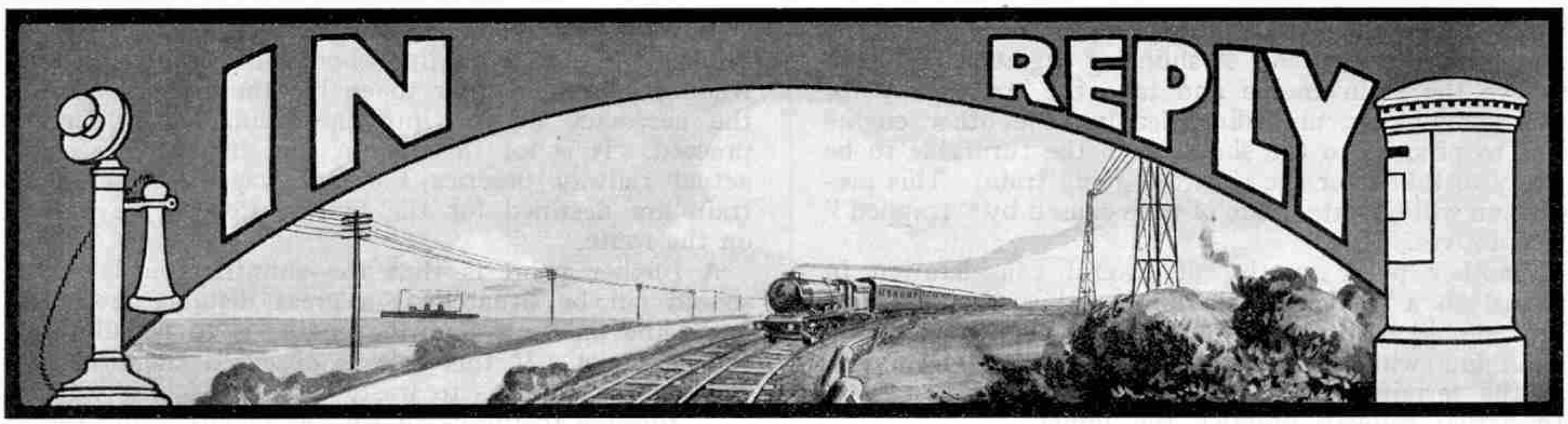
A further point is that the shunting yard proper should not be situated at a great distance from the main line unless a shunting engine is to be allocated to the depot. If this rule is observed the necessity for locomotives to waste time in backing wagons through to the depot will be obviated, and therefore the dropping of wagons at their various destinations will be quite simple and will occupy only a very short time.

It is impossible to lay down definite and detailed rules to be followed when planning goods yards, but if the few hints already given are followed out little trouble should be experienced.

Goods train working will be found much more interesting if a strict timetable is adhered to as in actual Railway practice. There should be, for instance, two or three regular trains per hour, the number of course depending upon the length of timetable and the kind of layout that is being used. A point to remember in this connection is that a liberal allowance should always be made for delays due to passenger working and extra shunting operations that interrupt goods train working and that cannot be foreseen when a timetable is being prepared.

Some kind of provision must always be made in planning goods timetables for the even distribution of rolling stock. Probably the first train booked to run out of a depot every morning will be a long train of ' empties ' with various types of wagons allocated to the different stations on the line, according to the nature of the goods that are to be transported from the station in question. The engine of the train should be booked to return later in the day to the original depot, taking up loaded wagons, or dropping more empties at the stations on the route.

Some very interesting hours may be spent if some kind of definite scheme is adopted for the exchange of goods. A great deal of fun and excitement can be obtained by procuring a number of the Meccano Miniature Sacks (part number 122) which are of a convenient size for loading into gauge " 0 " rolling stock, and giving them definite numbers according to the number of stations on the line. These Sacks should then be mixed up and stacked in the goods yard of each station, to be sorted subsequently and loaded into separate wagons for collection and dispatch to their correct destinations.



Suggested Hornby Train Improvements

DOUBLE ARM GANTRY.—You will be interested to learn that we have definitely decided to introduce a signal gantry of this kind. (*Reply to W. F. L. Sear, Victoria, Australia*).

LONGER COACHES FOR 'M' SETS.—We appreciate the fact that the coaches included in the present 'M' Series are rather small and that larger coaches would look much better. On the other hand, if we were to include larger coaches with the small sets, prices would have to be increased and our whole purpose of supplying cheap train sets of this kind would be defeated. (*Reply to Aldo Toledano, Sao Paulo, Brazil*).

SAND PIPES.—The introduction of sandpipes to our present types of locomotives is an interesting proposal but, we fear, not quite suitable. Scale sand pipes would be very fragile and would quickly become bent and perhaps broken after the first derailment of the locomotive. (*Reply to G. Dobson, London, E.*6).

LIFE GUARDS.—Details of this kind certainly improve the appearance of any model engine but they also tend to increase the cost of production. It is possible that we shall introduce life guards later, however. (*Reply to G. Dobson, London, E.*6).

CHECK RAILS FOR POINTS.—This is certainly an interesting suggestion but we do not think it is necessary to make the addition to our present type of points. As long as enthusiasts take care to treat their Hornby points carefully, derailments should not occur, in spite of the absence of check rails. (*Reply to G. Dobson, London, E.*6).

'LOCO COAL ONLY' WAGONS.—The question of lettering some of our open 10-ton wagons 'Loco Coal Only' is being considered. We will make a further announcement later. (*Reply to T. Anthony, Glasgow*).

DETACHABLE BELL CRANKS.—Up to the present we have not had an opportunity of introducing detachable bell cranks into the Hornby Control System, but enthusiasts may rest assured that the matter will have the necessary consideration as soon as possible. (*Reply to G. R. Webb, Leatherhead, Surrey, and T. B. Grounds, Pewsey, Wilts.*).

LOWER BUFFER BEAMS.—You will be pleased to hear that on all new Hornby Railway Rolling Stock the buffer beams will be their correct scale height from the running surface of the rail. (*Reply to E. L. Winn, Camberwell, London, S.E.*5).

NAME BOARDS FOR STATIONS.—A set of name boards for L.N.E.R. Stations is now available, price 4/–. (*Reply to A. Robins, Sussex*).

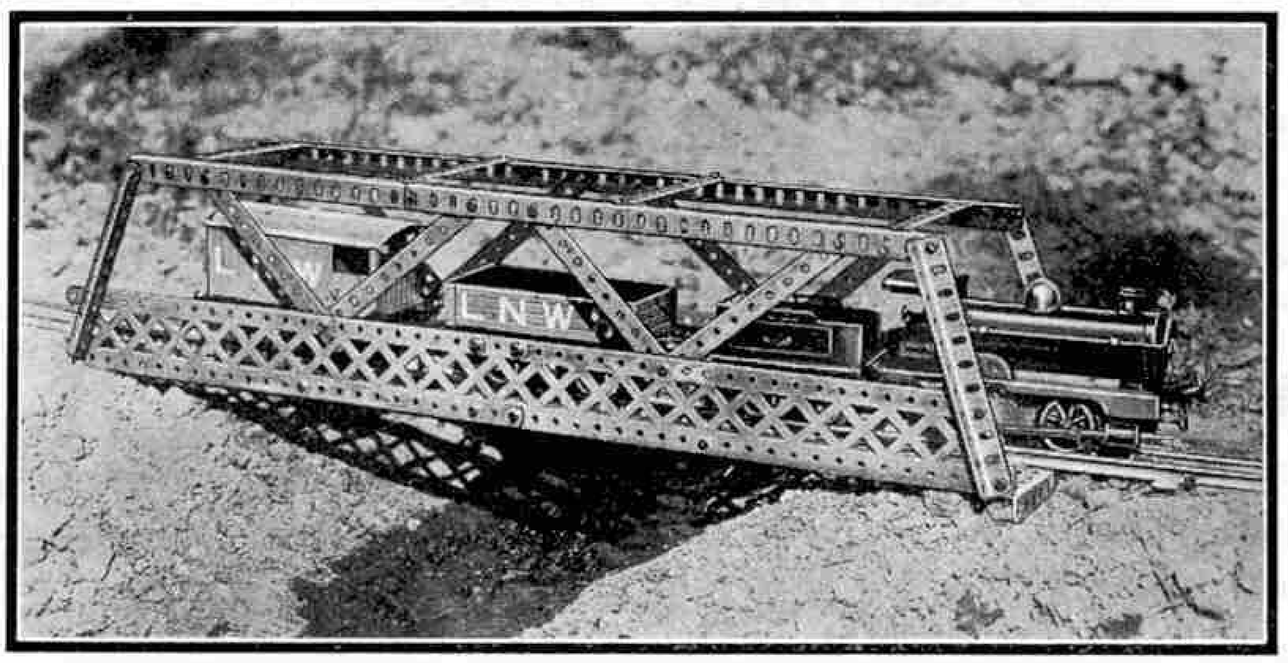
NEW LEVEL CROSSINGS.—We appreciate the fact that if the rails fitted to the level crossings were of the standard straight rail length, crossings could be fitted into a layout with far greater ease than at present. We are filing your idea and will give it due consideration, though it should be possible to rectify this more or less by the addition of two quarter rails. (*Reply to Ernest Mather, Nottingham*).

4-4-2 TANK ENGINES.—We are interested in your suggestion that our present No. 2 Tank Engines should have the rear four-wheeled bogie removed, as it looks rather cramped, and that its place should be taken by one of the No. 3 Pony Trucks. At present we do not see any special advantage to be gained by making this alteration, but we will consider your idea. (*Reply to C. Jones, Oxford*).

STEAM RAIL COACHES.—Since the extensive introduction of this type of coach by the L.N.E.R. we have received quite a number of letters from boys suggesting that we should also introduce models of them into the Hornby Series. The matter will have careful consideration. (*Reply to C. Potter, West Hartlepool, and others*).

TRAINS IN PRE-GROUP COLOURS.—We quite appreciate the suggestion that trains in the colours of the old railway companies would serve as an interesting souvenir but we do not think they would be popular. Hornby railway enthusiasts are always keen on having the very latest of everything. (*Reply to J. Goodman, Rossendale, Lancs.*).

SINGLE TRACK LEVEL CROSSING.—A level crossing of this kind has been introduced this season. (*Reply to T. Coleman, Norwich*).



This photograph illustrates how a Hornby enthusiast, A. R. Lyell, of Hawthorn, Victoria, Australia, overcame the difficulty of spanning a small stream that he found in his way whilst constructing a temporary garden layout. This is an excellent example of the way in which Meccano can be introduced effectively into a Hornby layout

COUPLINGS FOR 'M' LOCOMOTIVES.—Your idea regarding the introduction of 'M' Locomotives with couplings fitted to the front buffer beams is not practicable as these engines are not fitted with reversible mechanisms. (*Reply to F. S. Roychowdhury, Watford, Herts.*).

GREAT WESTERN CHIMNEYS.—We agree that if the chimneys on our G.W.R. models had copper bands painted on them, as in actual practice, they would look more realistic. It should be remembered, however, that alterations of this kind are expensive, and the advantages to be gained do not certainly warrant our undertaking them. (*Reply to P. R. Hall, Leicester; and R. B. Pritchard, Llandaff, Cardiff*).

SIX-WHEELED 20-TON BRAKE VAN.—The introduction of a 6-wheeled 20-ton Brake Van would certainly prove popular. We will remember this idea. (*Reply to Keith Faulkner, Pinner, Middlesex*).

OBSERVATION CARS.—The introduction of model observation cars has already been considered and we have decided that it would not be advisable to introduce them until the prototypes are more generally used on our home railways. (*Reply to Cecil Godson, Birkenhead*).

MINIATURE CRANE.—The small crane fitted to the Hornby Goods Platform may also be obtained separately, price 4/–. (*Reply to T. J. Jones, Manchester*).

HEAVIER TINPLATE WHEELS.—We agree that if the tinplate wheels now used on some of the Hornby Rolling Stock were made heavier, running would be improved. The cost of putting lead fillings into these wheels would be very great, however, and in any case we think it would be preferable to use the new Mansell Wheels which were announced in these pages recently. These are obtainable at 4d. per pair. (*Reply to Kenneth Jackson, Bolton*).

MECCANO RETARDERS.—We thank you for your design for a 'retarder' made out of Meccano and fitted to a Hornby Rail. If possible we shall publish your idea at some later date. (*Reply to G. Tucker, Chingford, London, E.C.*4).

ELECTRIC LIGHT FOR HORNBY STATIONS.—It is quite possible to light the station by using the ordinary lamp standards fitted with small electric bulbs. (*Reply to L. Hardingham, New Malden*).

LOCOMOTIVE COLOURING.—We do not consider that the adoption of the new standard colouring of the L.N.E. & L.M.S. Railway Companies would be very popular among Hornby enthusiasts. Goods engines with a dull black finish would lose a great deal of their attractiveness and the appearance of the Nos. 1 and 2 Passenger Engines would also be spoilt. (*Reply to F. Jeffery, Sunderland, Co. Durham*).

CRANK HANDLES FOR WINDING LOCOMOTIVES.—Your idea is not suitable, as it is more difficult to wind a locomotive by means of a crank handle than by means of the present type of Hornby key. (*Reply to W. S. Allwood, Stratford-on-Avon*).

GUARD'S VAN.—We realise that there is no Guard's Van suitable for use with a Pullman Train at the present moment, but your requirements should be satisfied by our new composite Pullman Car 'Arcadia.' (*Reply to Gerald Olive, St. Helens*).

No. 2 HORNBY WAGONS.—We note your idea regarding an open wagon fitted with four-wheeled bogies, and we will file it for consideration. (*Reply to R. N. Carr, Blythe, Northumberland*).

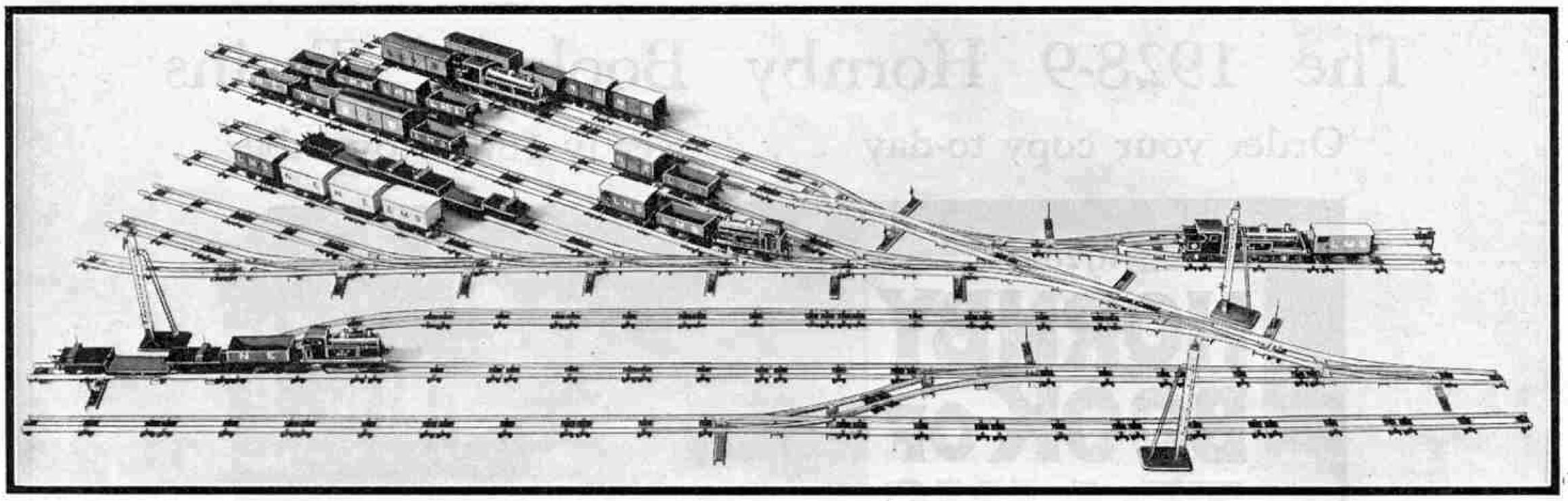
SLIP COACHES.—We thank you for your design for a Hornby slip coach apparatus. This is interesting but whether it will be effective in operation is rather doubtful. It is quite possible that we shall introduce slip coaches before very long. (*Reply to F. S. Roychowdhury, Watford*).

LOADING GAUGE.—We appreciate your remarks regarding our present type of loading gauge but we do not consider it necessary to carry out your suggestion to lower the swinging arch. (*Reply to M. Booth, Luton*).

STATION ACCESSORIES.—We intend to gradually increase our range of station accessories and we shall probably include miniature fire buckets, notice boards to passengers and a railway bookstall. (*Reply to G. Dobson, London, E.6; G. Jarrett, Umberleigh, N. Devon*).

VACUUM BRAKE PIPES.—We shall probably fit vacuum brake pipes to any new locomotives that we design. (*Reply to D. Pritchard, Cirencester*).

COAL IN TENDERS.—It is quite an easy matter to fit small selected pieces of coal into a tender and fix them in position by means of seccotine. We do not think it would be advisable to go into the coal trade! (*Reply to R. Beckett, Aberfoyle*).



Our photograph illustrates a typical shunting yard. The track is all standard Hornby tinplate track and the rolling stock also is of Hornby manufacture.

The two lines in the foreground connected by a crossing are the up and down main lines. It will be noticed that in accordance with actual railway practice, points on the main line are trailing wherever possible. The up line is provided with a loop to enable locomotives to run round their trains. This loop is guarded by a signal, as all vital points of this kind must have a signal placed close to them. The crossover, for instance, on the main line is guarded on the down line by a signal of its own, and on the up line by the same signal as the loop. There is a signal controlling the exit of the goods yard on to the main line.

The point to notice about the layout of the goods yard proper is the number of sidings that it is possible to get into a small area. In a distance of a little over 6 ft. it is possible to turn out no less than eight sidings from one line if the principle illustrated is used. On the extreme right-hand side, in the background, the lines lead to the engine shed, and a locomotive is seen waiting to take over a goods train. The necessary 20-ton brake van is attached to it.

A great number of interesting shunting operations can be carried out by Hornby enthusiasts if a plan similar to this is used.

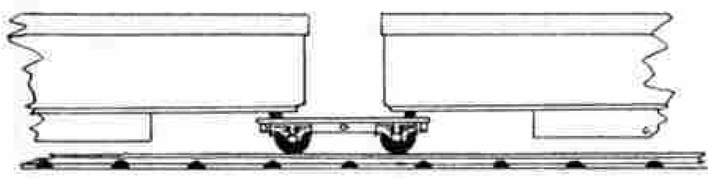
CARRIAGE SHEDS.—Sheds of this kind would take up far too much room on any model railway if they were constructed to correct scale dimensions and therefore we fear that it would not be a practical proposition to introduce them. (*Reply to N. Maxwell, Dublin*).

No. 1 ELECTRIC LOCOMOTIVES.—As stated before in these pages we are experimenting with a No. 1 locomotive fitted with an electric mechanism. The results are not yet available, but as soon as they are, we will make an announcement. (*Reply to A. J. White, Croydon*).

METROPOLITAN LOCOMOTIVES.—Although your idea for fitting the Electric Metropolitan Locomotives with two bogies and a flexible drive is quite a feasible one, we are afraid that the cost of the finished engine would be far too great to warrant the alteration. (*Reply o J. Lucas, Sunderland*).

RACING GOVERNORS.—Your governor must be rather an old one if it races. We suggest you oil it with a few drops of the thickest lubricating oil that you can obtain. This will have the effect of retarding the speed of your engine. (*Reply to S. Woods, Burnley*).

ORDINARY FLAT TRUCK.—We feel that there is no immediate need for a truck of this kind. (*Reply to Sidney Wilkinson, Newcastle-on-Tyne*).



ARTICULATED TRAIN SET.—We still receive many letters from readers who consider it would be a good idea to introduce articulated coaches into the Hornby Railway System. As a matter of fact, the appearance of an articulated set of Gauge '0' Coaches would not be as attractive as might be imagined. It would be necessary to have an unrealistic distance between the two coaches in order to allow them to negotiate safely the narrow curves found on most Gauge '0' layouts. (*Reply to R. G. M. Quarrie, York*).

ALTERED METROPOLITAN COACHES.—We shall consider the question of colouring the existing Metropolitan coaches to represent the rolling stock of the G.W., L.M.S., S.R. and L.N.E.R. (*Reply to J. Partridge, Southport, and N. E. Norman, Wimbledon, London, S.W.*20).

PLATE-LAYER'S TROLLEY.—Although these are seen very often on actual railways we consider that they would be liable to become a nuisance on a model railway layout. If you particularly require a plate-layer's trolley you should construct one from Meccano Parts. (*Reply to V. Shaw, Fleetwood*).

MINIATURE COAL DOCKS.—We will file this idea among our suggestions, for further consideration. (*Reply to P. Ellis, Dumfries*).

'H.O.' RAILWAY.—The letters you noticed stand for 'Half 0' which is equivalent to Gauge '00.' We cannot consider the introduction of 'H.O.' Hornby Trains at present. (*Reply to B. Simpson, London, S.E.*15).

AUTOMATIC TURNTABLE.—It would be quite possible to make a turntable of this kind, but the finished article would prove far too expensive to be popular. We consider that the present type of turntable leaves little to be desired. (*Reply to P. Mackintosh, Melbourne, Australia*).

ARMOURED TRAINS.—Your proposed armoured train is scarcely suitable for a model railway and we feel sure that it would not make a general appeal. (*Reply to V. Camm, Hornsey*).

COLLECTING SHOE FOR ELECTRIC LOCOMOTIVE.—We are interested in your design for a new collecting shoe but we do not consider that our present type is at all inefficient. Probably the fact that one of the shoes of your locomotive catches in the points is due to slight distortion as the result of an accident. (*Reply to S. Willmott, Manchester*).

LONGER LEVER FRAMES.—The suggestion that we should introduce larger signal boxes and lever frames is quite sound and we shall give it careful consideration. For the time being we think it should not be difficult to operate a large layout by means of two signal boxes. (*A. Mills, London, S.W.*1).

TRACK FENCING.—Track fencing undoubtedly lends additional finish to a layout. If we decide to introduce it it will be purchasable in standard lengths to suit all requirements. (*Reply to M. Thorburn, Toronto, Canada*).

RE-NAMING OF No. 3 G.W. LOCOMOTIVE.—We note your suggestion that we should change the name of the No. 3 Hornby 4-4-2 engine "*Caerphilly Castle*" to "*President*," and that we should number it 103. While agreeing that there is a remarkable similarity between the "*President*" and our model, we are afraid that such an alteration would not prove generally popular. The "*President*" is certainly not as well known as the famous "Castle" class locomotive that was on view at Wembley. (*Reply to W. J. Simmons, Birmingham*).

SLEEPING CARS.—As there is not a very great demand for sleeping cars, we are afraid that we cannot consider your suggestion at present. With the introduction of the 3rd class "sleeper" in actual practice, it is possible that we may consider the advisability of introducing models later. (*Reply to J. S. McLaren, Birkenhead*).

TRACK REVERSING FOR ELECTRIC LOCOMOTIVES.—With the present type of field-wound motor used in Hornby trains, any device for reversing the locomotive from the track would entail the incorporation of a solenoid, or some such arrangement, and a very complicated system of wiring. We are afraid therefore that the extra benefit derived would be out of all proportion to the cost. (*Reply to M. Laker, London, S.W.*18).

RUST-PROOF PAINT.—We do not propose to supply tins of paint for coating outdoor rails. Suitable paint may be obtained at a very moderate cost from any paint stores. (*Reply to J. T. Jones, York*).

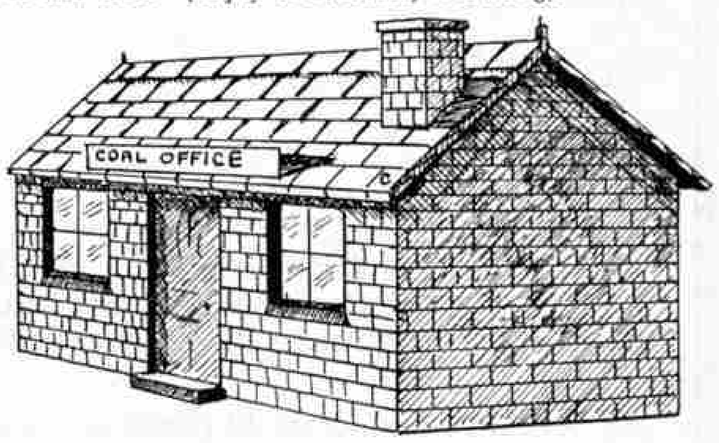
DOUBLE JUNCTIONS.—With the introduction of the new Hornby double track, it is very probable we shall introduce double junctions at some time in the future. At present, however, we are unable to go further into this matter. (*Reply to F. S. Fowlston, Beaworthy*).

ELECTRIC POINTS FITTED FOR CONTROL.—We hope shortly to be able to make a further announcement in this respect. At present, however, it is not possible to obtain electrical points fitted with the necessary bell cranks and couplings for use in conjunction with the Hornby Control System. (*Reply to K. A. Key, Paisley*).

MODEL MILK CONTAINER WAGONS.—As announced in these pages previously, we hope to produce a wagon of this kind shortly. We feel sure that such a model will make a general appeal among Hornby train enthusiasts. (*Reply to J. T. Cashin, Portadown*).

"KING ARTHUR" LOCOMOTIVE.—We do not propose to name our No. 3 Southern locomotive after the "*King Arthur*" engine of the Southern Railway. The name of the locomotive that will be supplied with the "*Continental Express*" will be "*Lord Nelson*" No. E.850.—(*Reply to P. Weston, Ipswich*).

CLOCKWORK ELECTRIC TRAINS.—We are sorry that you object to our fitting the Metropolitan locomotive with a clockwork motor. It is possible for those who desire a model of this kind worked by electricity to purchase one. We supply both a high and a low voltage model. You were probably unaware of this fact. (*Reply to S. Allen, Worthing*).



COAL OFFICE.—Several readers have suggested the introduction of small coal offices to place in their model goods yard. This is an interesting idea and we shall give it careful consideration. (*Reply to M. Livingstone-Learmouth, Kingswood, Surrey, and others*).

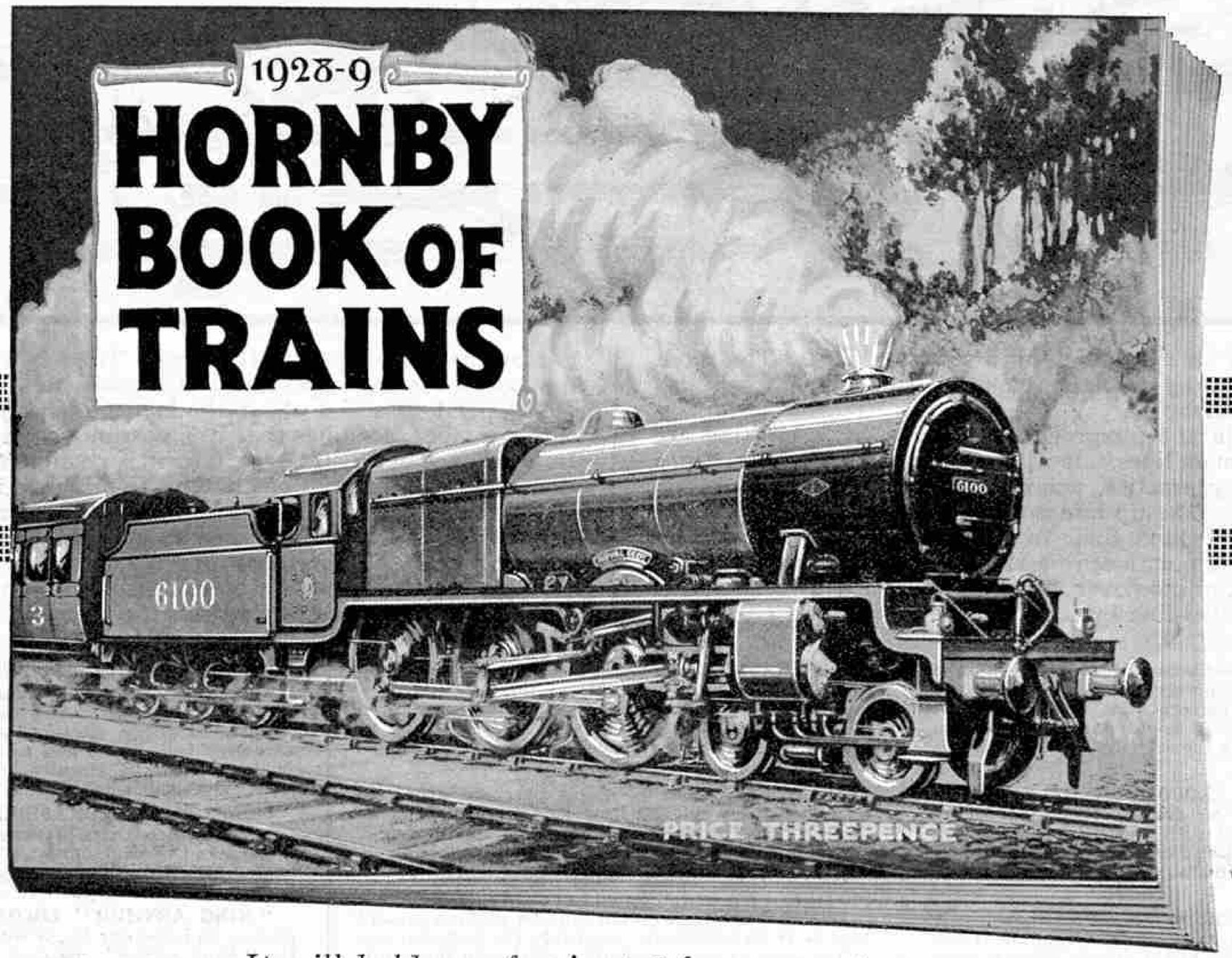
HOLLOW WINDING SPINDLE.—We do not see that there are any great advantages to be gained by altering the present type of winding shaft that we fit to our clockwork motors. An alteration such as you suggest would entail a great deal of expense. (*Reply to V. Young, Red Hill*).

SPRING BUFFERS FOR LOCOMOTIVES.—We consider details of this kind are quite unnecessary and only serve to increase the price of locomotives and rolling stock. (*Reply to Eric Steven, Manchester*).

HORNBY STEAM LOCOMOTIVES.—We do not agree that steam locomotives give very much more satisfactory performances than clockwork locomotives, as you state. In fact, they are distinctly inferior for timetable working. In any case, at present we cannot possibly consider the introduction of Hornby steam locomotives, though it is possible at some time in the future we may go into the question further. (*Reply to John Jamieson, Coventry*).

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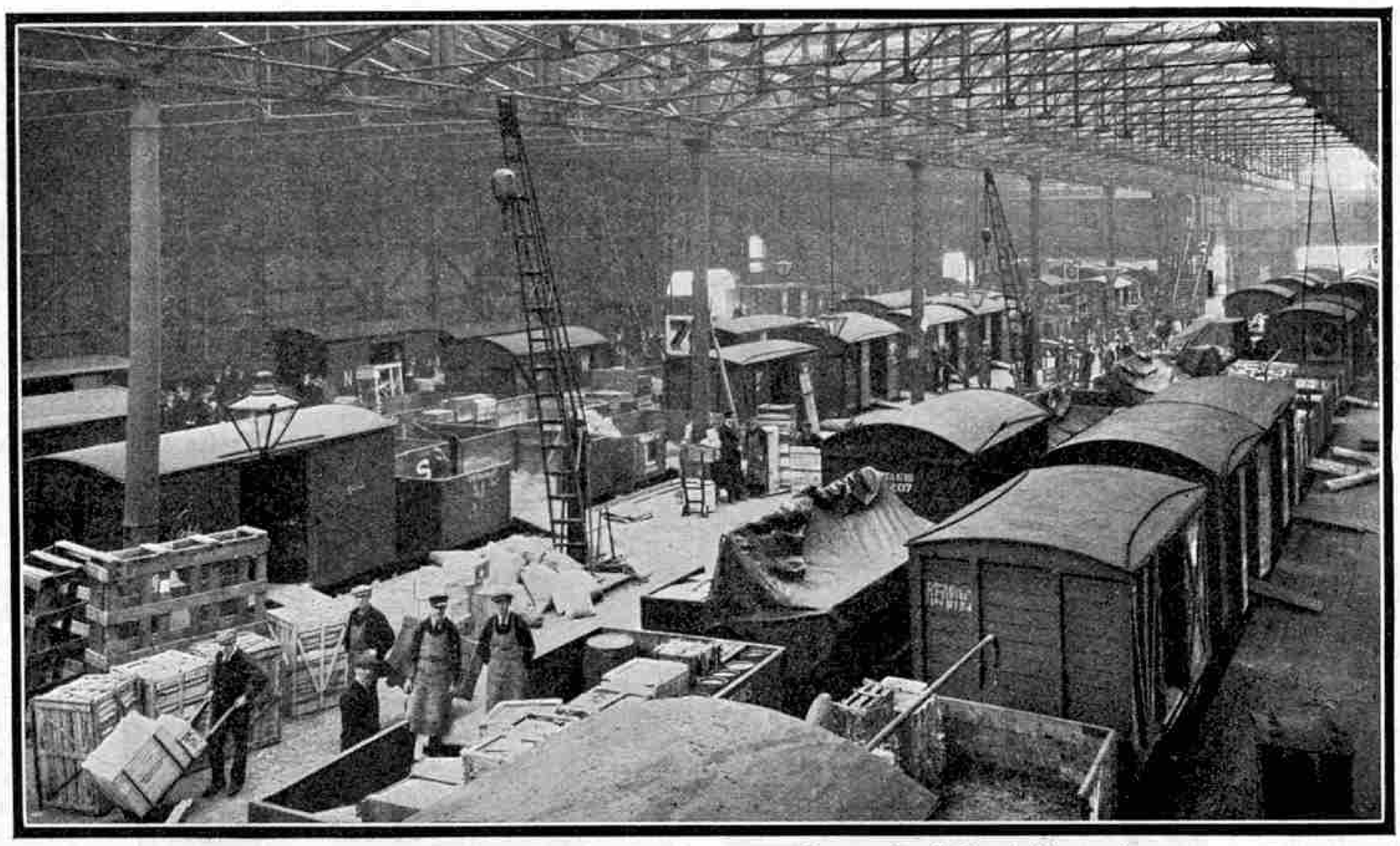
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The Romance of Goods Traffic

How Railways Work While We Sleep

THE use of the word "Romance" in connection with the carrying of railway goods traffic may at first sight appear altogether out of place. A long goods train of perhaps 50 or 60 wagons, as it passes through a station where we are waiting for our train, is apt to appear dull and commonplace in the extreme. Its clattering noise irritates us and we are glad when it has gone. Most of us scarcely give a thought to the load that is being carried—where all the different items come from; where they are going to; how they have been gathered together and loaded into the wagons, and how they will be dispersed in due course to their respective destinations.

It is an indisputable fact, however, that the uninteresting, clattering goods train is often of far more value to the community than the express passenger train to which it must give way. With that fact in mind it is easy to understand that the more important part of a railway's daily life is played behind the scenes. While we are enjoying an evening by the fireside or sleeping in the quiet early morning hours, goods yards up and down the country are scenes of amazing industry.



The Scene in a busy goods warehouse at the peak of the daily rush

To the casual observer the scene in a busy railway depot where a large volume of traffic is handled suggests hopeless confusion and absolute disorganisation. This impression, however, is entirely wrong. It is only necessary to watch carefully for a while in order to realise that beneath the apparent disorder there is a definite system.

A big goods station will receive traffic for thousands of destinations each day. For only a few of those destination stations is it possible to make up full loads, yet economical working demands that each wagon despatched must be full. Obviously, then, the solution is to combine the small items of traffic and forward them in one wagon to some intermediate point where they can be sorted, combined with traffic from other parts of the country and reforwarded to their individual destinations.

Out in the goods yard itself the bulk traffic requiring individual wagons for each consignment is handled and passed on to the marshalling yard, where the lines of loaded goods trucks are sorted, so that wagons for chosen destinations are brought together to make complete trains. Marshalling yards are of several types, but the most important are those known respectively as "hump" and "gravitation" yards. In both types of yard the wagons run down an incline into their destination roads. In the hump yard a shunting engine is required to push the wagons over a mound of earth—the hump—to give them the impetus necessary to carry them into their destination roads. In a gravitation yard the whole layout is inclined, and immediately the wagons are released from the train that has brought them from the goods yard they commence to run down.

A typical gravitation yard is that at Edge Hill, Liverpool, on the L.M.S. Railway, and here some 3,000 wagons are handled every 24 hours. At the height of the busiest period, trains of wagons and trucks are passing up from the goods depot to the marshalling yard every five minutes. Throughout the night the whole of the 60 acres covered by the "gridiron," as the sorting layout is called, resounds with the clang of buffer meeting buffer as wagons are shunted into position and completed trains steam out.

The fluctuations in the quantity of daily traffic render it impossible to lay down regular schedules for all goods traffic. Thus it comes about that the problems associated with the working of goods trains are of a very different nature from those connected with passenger trains. The nature and weight of a passenger train can be predetermined to within a few tons, for the combined weight of the passengers and their luggage is but a small fraction of the whole weight of a train. It is thus a simple matter to lay down in advance a schedule for a passenger train of a certain weight to be hauled by an engine of suitable power, with absolute confidence that the schedule will be maintained. The weight of a goods train, on the other hand, is subject to fluctuations. The rolling stock is merely a minor part of the load, and the actual load in any wagon may be either considerably greater or considerably less than that of the vehicle itself. In other words, the weight of the average goods train is a matter for speculation until the train is actually made up in the shunting yard. It will be readily understood that, unless very careful supervision is maintained, the movements of goods trains from one part of the country to another may be a source of constant and serious delays. In order to guard against this the railway companies have instituted elaborate systems of control.

The more one learns of the inner workings of railway goods traffic the greater becomes one's admiration for the extraordinary organisation that has been built up bit by bit from the earliest days of railways. There is, in fact, something almost uncanny about the manner in which the nation's merchandise is moving hour by hour and day by day with scarcely a hitch.

This year's edition of the "*Hornby Book of Trains*" has been prepared specially to give an insight into this subject. The various chapters of the book describe how the goods are received in vast warehouses and sorted and loaded into their proper wagons, and how the loaded wagons are handled in the great marshalling yards, according to their various destinations, and formed into complete trains. The magnificent engines that haul these heavy trains are passed in review and, finally, the manner in which the whole traffic is supervised and controlled is explained in detail. A special section deals with out-of-gauge traffic and the skilful and ingenious manner in which loads of abnormal size and shape are handled.

Suggestions Section Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(139)—Automatic Coin-in-the-slot Mechanism

(*A. M. Johnston, Dunstable*)

ALL Meccano boys are acquainted with automatic coin-in-the-slot machines, many varieties of which are to be met with on railway stations or sea-side piers. Most of these machines supply matches, cigarettes, or eatables on receipt of the coin, but some of them embody games of skill in which the coin is returned if the operator manipulates the apparatus correctly. (Meccano boys would score heavily here, of course !)

Automatic machines are also employed for more useful purposes, such as the issuing of tickets on the Underground stations of London. On insertion of the required amount for the fare the ticket is delivered to the intending passenger, who is thus saved the delay and inconvenience of booking his fare at the usual office. Some of the machines dispense entirely with the services of booking clerks, by issuing an innumerable variety of tickets and counting the passengers as they pass through the turnstiles, etc.

The most interesting use to which automatic machines may be put—from the Meccano boy's point of view, that is—is its application in driving Meccano models. A coin-in-the-slot attachment in almost any working model would prove a never ending source of attraction to spectators. Matters can be arranged so that on payment of a penny the model is set in motion for a pre-arranged period and then ceases automatically. It cannot be started again unless another coin is inserted in the slot. The possibilities of such a device installed in Meccano Club exhibitions, etc., will be obvious. Even in the home, a model controlled by an automatic coin mechanism might prove, if placed judiciously, a remunerative adjunct to the Meccano boy's equipment !

A very simple penny-in-the-slot device that may be attached to almost any Meccano model is shown in Fig. 139. The essential mechanism only is shown ; the frame, etc., may of course be modified to suit individual requirements.

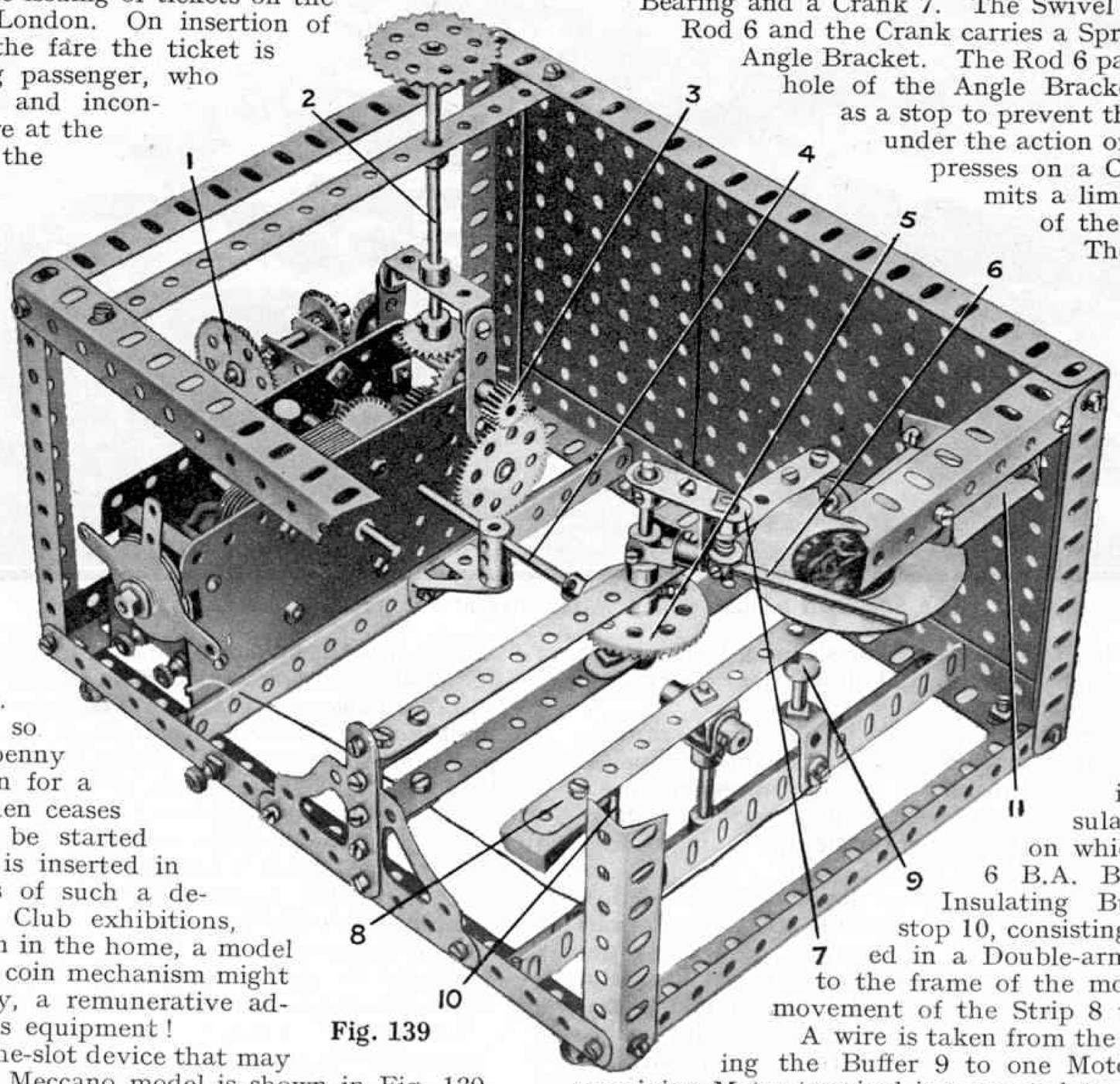


Fig. 139

Arrangement of the Mechanism

A Worm on the armature spindle of the Motor engages with a 57-teeth Gear Wheel 1 on a short Rod that is journalled in a Channel Bearing bolted to the side plates of the Motor. A $\frac{7}{8}$" Bevel attached to the end of this Rod meshes with a similar Bevel on a transverse Rod that carries another Bevel and the $\frac{1}{2}$" Pinion 3. The Bevel on this Rod engages with a second Bevel on a vertical Rod 2, off which the drive to the model is taken. In the illustration the Rod is equipped for a Sprocket Chain drive, but any other driving method, such as belt and pulleys (see Standard Mechanisms Nos. 15 to 20), or Bevels and shafting, etc., may be substituted if desired.

The Pinion 3 meshes with a 57-teeth Gear Wheel secured on a Rod that also carries a $\frac{3}{4}$" Pinion. The latter engages with a 50-teeth Gear on a $4\frac{1}{2}$" Rod 4 journalled in the Motor side plates and also in an additional bearing consisting of a Coupling secured to a Trunnion. The $1\frac{1}{2}$" Bevel 5 is in mesh with a $\frac{1}{2}$" Bevel on the end of the Rod 4, and is secured to a Rod journalled in transverse $7\frac{1}{2}$" Strips. This latter Rod carries on its upper end a Swivel Bearing and a Crank 7. The Swivel Bearing supports a $3\frac{1}{2}$" Rod 6 and the Crank carries a Spring Buffer and a $1" \times \frac{1}{2}"$ Angle Bracket. The Rod 6 passes through the slotted hole of the Angle Bracket which, while acting as a stop to prevent the Rod dropping too far under the action of the Spring Buffer that presses on a Collar on the Rod, permits a limited upward movement of the latter.

The $5\frac{1}{2}$" Strip 8 is mounted pivotally as shown in the illustration and carries a 25-gramme Weight at one end and at the other a Face Plate which receives the coin. The Face Plate is covered with a circular piece of linen in order to prevent the coin slipping off too freely.

A Contact Screw (part No. 307) is secured to the Strip 8 immediately above a Buffer 9 mounted on a $1" \times \frac{1}{2}"$ Angle Bracket. The latter is secured to and insulated from the Girder on which it is mounted, by a 6 B.A. Bolt equipped with an Insulating Bush and Washer. A stop 10, consisting of a short Rod mounted in a Double-arm Crank that is bolted to the frame of the model, limits the vertical movement of the Strip 8 to about 1/16".

A wire is taken from the Angle Bracket supporting the Buffer 9 to one Motor terminal, whilst the remaining Motor terminal is connected to a 4-volt Accumulator. The other terminal of the latter is attached to a terminal that is in metallic contact with the frame of the model.

When the coin is placed in the chute 11, it falls on to the Face Plate and its weight causes the arm 8 to drop and the Contact Screw to make contact with the top of the Buffer 9. This completes the electric circuit (the Motor switch having previously been placed in the "on" position) and the Motor is started. The arm 6 promptly commences to move, rotating bodily with the Rod of the Bevel 5 until it reaches the position shown, in which it is about to sweep the penny off the Face Plate, thereby permitting the Strip 8 to rise and break the circuit.

The object of the Spring arrangement on the Rod 8 is to enable the latter to ride over the edge of the Face Plate smoothly and easily without the possibility of over-riding the coin.

(140)—Meccano Screw Jack

(H. Dixon, Canterbury)

Jacks must be familiar objects to all Meccano boys, for they are almost indispensable to every workshop that handles heavy machinery. A simple form of jack is also necessary to every motorist.

The model illustrated in Fig. 140 is an example of a typical lever-operated screw jack. The model will be found capable of lifting heavy loads and no doubt Meccano boys will be able to put it to practical use in connection with their model-building.

The framework of the model is strongly constructed from Angle Girders, a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate forming the base. The short Rod on which the Bush Wheel 4 is secured, is journalled in a Double Bent Strip and a $1\frac{1}{2}''$ Strip bolted between two $1''$ Triangular Plates that are attached to the upright Angle Girders. A $7\frac{1}{2}''$ Strip 1 mounted pivotally on this Rod forms the operating lever; it carries two Pawls 3 that are mounted loosely on a $1\frac{1}{2}''$ Rod and held in place by Collars. Each Pawl engages with a Ratchet Wheel secured to the Rod of the Bush Wheel 4.

On operation of the lever one Pawl rotates the wheel 4 in one direction while the other rotates it in the reverse direction, and each Pawl may be withdrawn from its respective Ratchet by means of the levers 2. These consist of Cranks mounted loosely on a short Rod and prolonged by $2''$ Strips. The Cranks are connected to the Pawls by lengths of wire attached to $\frac{3}{8}''$ Bolts that are inserted in the tapped holes of both the Cranks and the Pawls and locked in place by nuts. Short lengths of Spring Cord keep the Pawls normally in engagement with the teeth of the Ratchet Wheels.

The Threaded Rod 5 is rotated by means of a $\frac{7}{8}''$ Bevel on its lower end that meshes with a similar Bevel on the Rod carrying the Bush Wheel 4. A Threaded Boss on the Rod 5 is connected by the two $1\frac{1}{2}''$ Strips 6, to two new-style Collars secured on the parallel vertical Rods. The latter carry at their upper ends a pair of $2\frac{1}{2}''$ small radius Curved Strips. These Strips take the weight of the load and are secured to Collars by means of bolts spaced with two Washers.

When it is desired to throw one of the Pawls out of engagement so that the lever 1 rotates the Bush Wheel shaft in one direction only, the Pin 7 is passed through a Strip 2 that controls the Pawl and through a hole in the lever. The jack may be manipulated when no load is applied by disengaging the Pawls and turning the Bush Wheel.

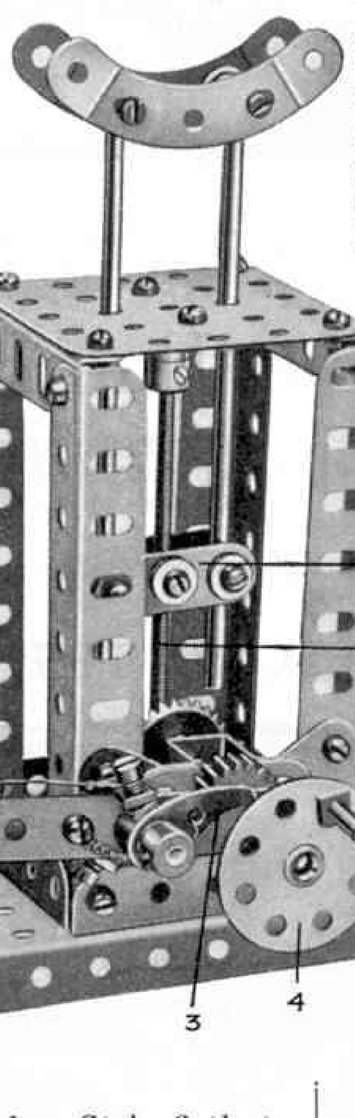


Fig. 140

(141)—Two-speed Constant-mesh Gear Box

(K. Cameron, London, S.E.)

Perhaps no other mechanism receives so much attention from Meccano boys as the gear box. This is not surprising, however, for the problem of designing really efficient speed-changing devices constantly engages the best brains of the engineering profession.

Fig. 141 shows an extremely simple and efficient gear box of the constant-mesh type. The great advantage of this type is that the shafts do not have to be moved in order to change gear. Hence the driving connections are simplified and wear and tear on gears minimised.

The driving shaft has two $1''$ fast Pulleys 3 and 4 secured to it. Placed against these Pulleys, but loose on the shaft, are a 50-teeth Gear Wheel 1 and a $1''$ Gear Wheel 2. Also on the shaft are two Compression Springs mounted between Washers and placed one on each side of a Collar 6, which is also free on the shaft. The Collar is connected to a lever 5 and the latter is attached pivotally to the base plate by a bolt and two nuts (see Standard Mechanism No. 262).

With the lever normal, or in the central position, no power is transmitted to the secondary Rod 7, but on moving the lever to one side or the other, one of the Springs is caused to press its respective gear Wheel firmly against a rubber-shod Pulley, and consequently the Gear Wheel commences to revolve "solid" with the driving shaft, whilst the other Gear Wheel continues to ride idly upon it. Hence, slight movements of the lever 5 will throw the Rod 7 out of engagement, cause it to be driven at the same speed as the driving shaft, or cause it to rotate twice as fast as the driving shaft.

It should be a simple matter to construct on the lines suggested above a very efficient gear box suitable for incorporation in a model motor chassis.

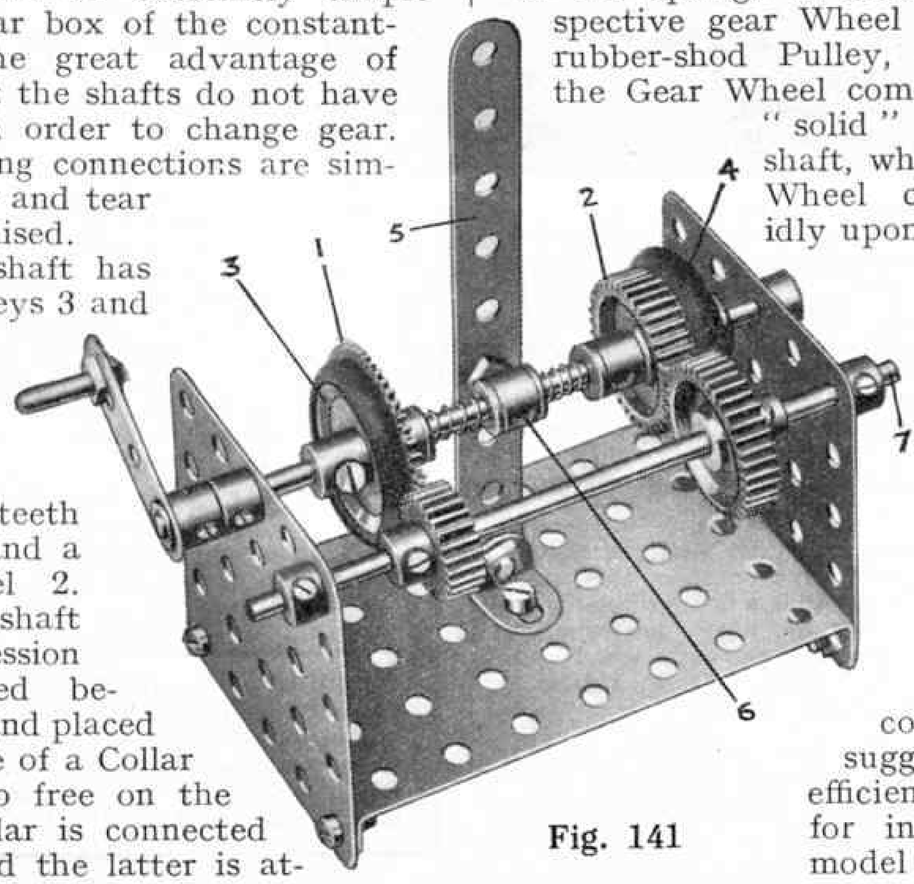


Fig. 141

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

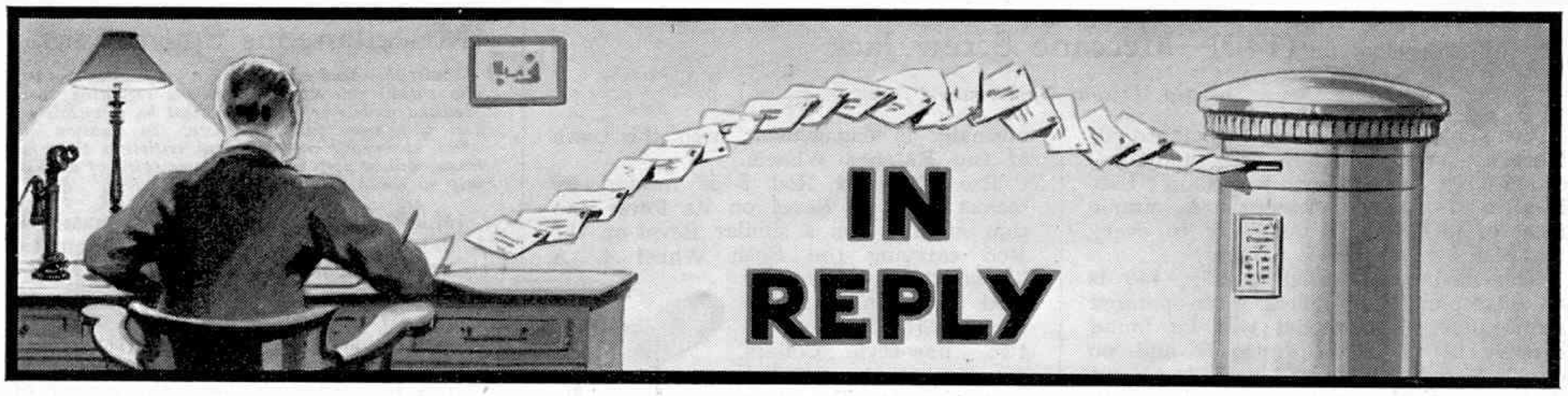
(M.28). Automatic Brake for Chassis.—A novel suggestion for an automatic electrically-operated brake has been received from S. Bell (Southport). A weighted lever, or pendulum, is mounted in the chassis so that when the latter runs down a gradient the pendulum swings forward and closes the circuit of the solonoids that operate the brakes. It is an ingenious idea, but a serious disadvantage is that the brakes would not function if the vehicle were to run backward down a hill!

(M.29). Intermittent Motion.—An intermittent motion often is required and model builders will find that a suggestion by G. Redfern (Matlock) will serve the purpose admirably. A $3''$ Pulley or a Face Plate is secured to a Rod journalled in suitable bearings, and a second Rod carrying a $\frac{1}{2}''$ Pinion is arranged parellel to, but one inch from, the first Rod. A $\frac{1}{2}''$ Pinion is attached rigidly to the side of the Pulley or Face Plate and matters arranged so that the Pinions engage with one another once in every revolution of the $3''$ Pulley. Thus the second Rod is given a brief intermittent motion.

(M.30). Burglar Alarm.—A simple burglar alarm suggested by W. Ryan (Dungarvan) consists essentially of a $5\frac{1}{2}''$ Strip, one end of which is screwed down to the floor, beneath a mat, while the other end is bent slightly upward. Under the raised end a contact stud is placed. This may consist of a drawing pin or brass screw, etc. One of the wires from the battery is taken to the Strip and one of the wires from the bell is connected to the contact stud. If anyone steps on the mat they press the end of the Strip on to the contact, thus ringing the bell. This is an excellent idea but we consider that a Flat Plate or something of even larger area would be more efficient than the Strip, for the burglar might not always be so obliging as to step exactly on the required spot!

(M.31). Reinforced Angle Connection.—In many cases where two parts are connected at right angles by means of an Angle Bracket there is a tendency for the Bracket to bend. "In order to counteract this," writes R. Penoyre (Chipping Warden, near Banbury), "use two Angle Brackets, one outside and one inside the angle formed between the parts, in such a manner that the slot in the outside Bracket is opposite the round hole of the inside Bracket. When bolted together securely an exceedingly strong joint is formed." A very useful suggestion that should be applicable in a number of cases.

(M.32).—Large Contrate Wheels.—Victor Lopes (Demerara, British Guiana) suggests that by securing Rack Strips round the periphery of a Face Plate, a large crown or Contrate Wheel may be formed. The Rack Strips must be bent to the radius of the Face Plate, to which they are secured by Angle Brackets. A still larger Contrate Wheel may be obtained by bolting Rack Strips to the circumference of a Hub Disc. These ideas will occasionally prove useful.



In this and the following page we reply to suggestions regarding improvements or additions to the Meccano system. We receive many hundreds of such suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on separate sheets of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Liverpool.

Suggested Meccano Improvements

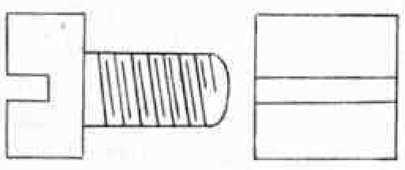
NEW CONTRATE WHEEL.—A contrate wheel similar in many respects to the Bevel Wheels but having the teeth cut parallel to its face and not at an angle as in the former wheels, would be of little use to the system. You suggest that this wheel could be used to form a right angle drive in conjunction with the existing Pinions, but we would point out to you that this could not be done without undue friction occurring. It would therefore be necessary to introduce a special type of pinion to mesh with the wheel. We would draw your attention to the fact that a very smooth and powerful drive can already be obtained by using the 1½" Bevel (Part No. 30a) in conjunction with the ½" Bevel (Part No. 30b). (*Reply to A. Bower, Wanstead, E.*11).

MAGNETIC CLUTCH.—A Clutch consisting of two small magnetised steel plates fitted with bosses would form an interesting addition to the Meccano system. A clutch of this type, however, is more of a curiosity than a practical mechanism, and it would provide a far less positive drive than the existing Dog Clutch or the single-plate built-up clutch incorporated in the Meccano Motor Chassis. There appears to be possibilities in your suggestion, however, so you may be sure that we will not lose sight of it. (*Reply to T. Parry, Finchley, N.*3).

ENAMELLING OF MECCANO PARTS.—Your suggestion that all small parts such as Flat Brackets, Double Brackets, etc., should be enamelled is interesting and will be considered. In the meantime we would suggest that you try enamelling these parts either red or green, with the special enamel which we now supply. The price is 8d. per tin (either colour). (*Reply to A. Marley, Wigan*).

IMPROVED THREADED PIN.—A slight increase in the length of the plain portion of the Threaded Pin would doubtless be an advantage and we will therefore attend to your suggestion. A further improvement to the Threaded Pin would also be to lengthen the threaded portion, thus allowing two lock nuts to be fastened to it more easily. This alteration may be carried out in the future. (*Reply to James Knox, Hawkesbury, Ontario, Canada*).

IMPROVED BOLT.—We have received from time to time numerous suggestions for improvements in the design of the standard bolt (No. 37b). Your idea that the bolt should be given a "nut" head (see sketch) is interesting and would certainly be of assistance to model-builders when they wish to tighten a bolt and nut by means of two spanners. We think, however, that the slight advantage gained by shaping the heads in this manner would not compensate for the loss of realism that would result. Although it may not be generally recognised, small circular bolt heads studded over a model often greatly add to its appearance and if the bolt heads were manufactured square the neatness of the models would suffer. With a view to further improving the appearance of "this most vital component of any Meccano model" we are considering redesigning the heads of the bolts so that the new type will have the appearance of rivets. (A further announcement on this subject later). (*Reply to J. A. Moffat, Aberdeen*).



NEW TYPE ROD.—Numerous suggestions have been brought to our notice to the effect that a "flat" should be cut on the existing Axle Rods so that a more positive connection might be made between a Wheel and an Axle Rod. We consider this unnecessary, for when it is found that a firm grip cannot be obtained, it is a sign that too heavy a strain is being placed upon the mechanism, with which it is naturally unable to cope. (*Reply to J. F. Morton, Brixton; J. Pettifor, Blackheath, S.E.*3).

SHIP'S PROPELLER.—This is an article that would have very few uses if incorporated in the system and we cannot therefore consider its production. (*Reply to D. S. Bond, Ilford*).

IMPROVED REVERSING LEVER.—We note you advocate that the reversing lever of the Clockwork Motor should be shortened considerably. We were interested in your suggestions but are at a loss to know what advantage would result through carrying out this alteration. The length of the existing reversing lever has been found, after considerable experiment, to be the most satisfactory for all general purposes. (*Reply to F. C. Dodridge, London; F. Knowles, Burnley*).

NEW TYPE BRACKET.—A Flat Bracket twisted so that each end is in a different plane would form quite a useful part. We are, however, of the opinion that existing parts could be used efficiently in place of your suggested part. Your bracket would, however, score over one made from existing parts on the point of neatness. (*Reply to S. Foreman, Preston, Ontario*).

SPRING COUPLING.—The idea of introducing a coupling consisting of two Collars with a short strong spring fastened between them, has been brought to our notice previously and although we have given it careful consideration we do not consider that your suggested coupling offers any advantage over the Universal Coupling that is already standard to the system. Moreover the Universal Coupling is a reproduction of an actual engineering mechanism and is therefore better suited for inclusion in the Meccano system than your suggested part, which is not based on sound engineering principles. (*Reply to S. Foreman, Preston, Ontario, Canada*).

NEW EYE PIECE.—We are giving careful attention to your suggestion that an eye piece so made that it could be fitted to Angle Girders, should be manufactured. This part would no doubt be particularly useful in the construction of locomotive crossheads, etc., as the use of Angle Girders as slide bars would result in a much stronger mechanism than if the ordinary Strips were used. (*Reply to J. Ager, Isleworth*).

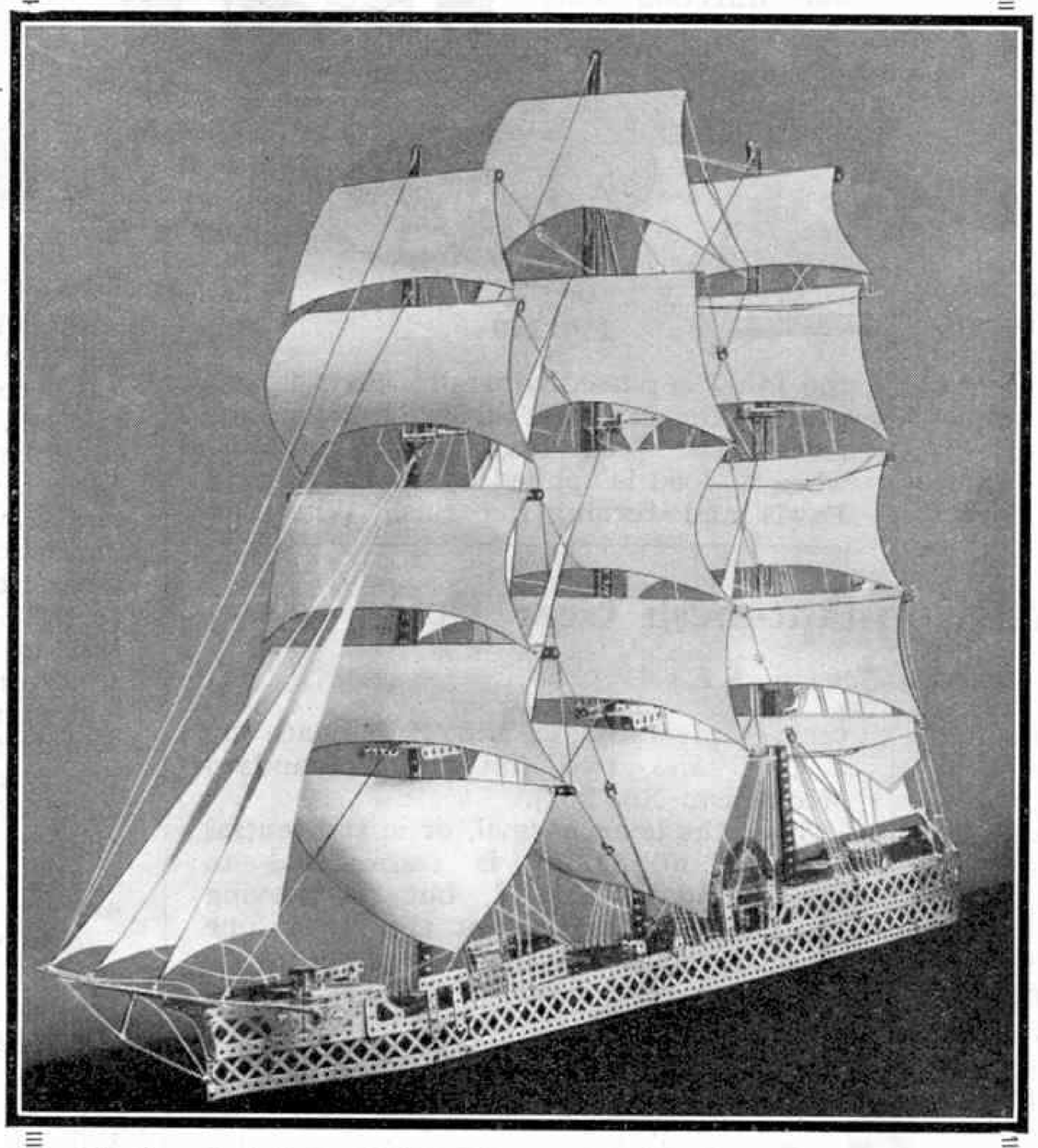
NEW BRACED GIRDERS.—We were interested in your suggestion that broader braced girders should be introduced. We have not up to the moment found the need for girders of this type in Meccano constructional work but no doubt they would be quite useful in certain cases. We are therefore keeping your idea before us for further attention. (*Reply to K. Renault, St. Heliers, Jersey, C.I.*).

"HEART" CAM.—We have inspected your sketch of a suggested cam and agree that it would be a very useful component if introduced to the system. The type shown in your drawing is known as a "heart" cam and is to be found in many engineering mechanisms. We are keeping your suggestion before us and will comment upon it further in the near future. (*Reply to A. R. Jones, Berwick*).

6 B.A. WASHERS.—This is an interesting suggestion, for when using the 6 B.A. Screw and Terminal in the construction of electrical models small brass washers frequently are required. We are making a note of your idea. (*Reply to R. Jevons, Acton, W.*3).

IMPORTANT.—In connection with Meccano Week (November 30th—December 7th) we are organising a Grand Model-building Competition, the prizes in which total £100. Full particulars will appear next month. Any type of model may be submitted. Start building now!

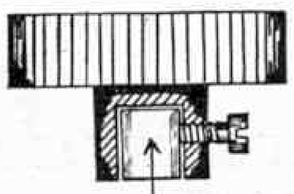
BEFORE THE DAYS OF STEAM!



The days of wind-propelled vessels are over and steam now rules the seas, but although the modern vessel may be many times more efficient than its forerunner it cannot equal the latter in grace and beauty, as this photograph of a full-rigged sailing ship clearly shows. The model was constructed by Leslie Hope, of Weston-super-Mare, and carried off the First Prize in Section A of the "March" Competition. The framework and masts of this excellent model are constructed entirely from Meccano parts, while the sails, which consist of white cardboard, give a "lifelike" touch to the finished ship. The model would form a fitting ornament for a Meccano boy's "den."

Suggested Meccano Improvements—(*Continued*)

INSULATING KNOB.—A special milled knob made from bakelite or some other insulating substance, would be quite useful in constructing switch gear and other electrical apparatus in Meccano. You suggest that the knob should be drilled so as to admit a Threaded Boss, the Boss and knob to be secured to each other by a bolt passing through the knob into the lateral hole of the Boss (see accompanying sketch). This would allow a length of Screwed Rod being fastened to the knob, or alternatively, a Collar might be placed in the knob and an Axle Rod used. This suggestion is well thought out and we will keep it before us. (*Reply to A. P. Whittaker, Newark*).



SPACING COLLARS.—There is no need for us to introduce spacing collars half or quarter thickness of the standard Collar, as a number of Washers can be substituted where a spacing collar is required. (*Reply to Leonard Ison, Croxton, Victoria*).

SPECIAL FUSE.—We note you suggest that special fuse wire should be included in the list of Electrical Parts as it would be useful in safeguarding the accumulator from accidental "shorts," which are very detrimental to its working. Your suggestion appears to be quite sound and we will go into the question of introducing special fuse wire in the future. (*Reply to W. C. Russell, Benoni, Transvaal, S. Africa*).

DOUBLE WIDTH GEAR WHEELS.—Although Double Width Pinions have been found of considerable use since they were introduced, we do not consider that any great advantage would result from making a similar alteration to the 57 and 50-teeth Gear Wheels. However, we are keeping your idea before us for further attention. (*Reply to R. Helliwell, Southend-on-Sea*).

TRIPLE THROW CRANKSHAFT.—This is a part that can be constructed quite simply from existing parts and there would be no advantage therefore in introducing a separate unit. An example of a built up Crankshaft will be found in the Standard Mechanisms Manual (detail No. 274). (*Reply to Boey Pah Yeng, Kedah, Malay*).

MODEL BOATS.—At present it is totally impossible for us to consider manufacturing clockwork model boats. Moreover, we do not think that they would be very popular if introduced, as we have not up to the moment received any considerable number of requests for the manufacture of this type of model. (*Reply to C. C. Tomkinson, Astley, near Stourport*).

LARGE FACE PLATES.—The need for a Face Plate of about 4" diameter has not up to the present been brought to our notice, but we agree that if a plate of this type were produced, together with a Wheel Flange to fit, it would find several uses in the construction of model locomotives. We are therefore attending to your suggestion and will comment upon it in a future issue. (*Reply to J. Morris, Vennes, Switzerland*).

NEW SCREWDRIVER.—We were interested in your suggestion that a new type of screwdriver should be introduced, the new tool to have a square hole stamped in the blade so that it might be used as a spanner in screwing up nuts, etc. This is an exceedingly good idea and we are keeping it before us with a view to introducing it in the future. We agree that it is often necessary in model-building to use two spanners, and your suggested tool would therefore come in very handy. (*Reply to R. Johnson, Moseley, Birmingham*).

3" GEAR WHEEL.—We do not consider it advisable to add a 3" gear wheel to the range of Meccano Gears as it is already quite comprehensive. You apparently think that a 12 : 1 gear ratio could be more simply arranged if this wheel were introduced but as it is possible to obtain a 12 : 1 ratio with existing parts your suggested wheel could not be introduced for this reason alone. However, we are keeping your idea before us. (*Reply to R. Loveland, Haywards Heath*).

NEW COLLAR.—We have received a considerable number of suggestions that the "spider" incorporated in the Universal Coupling should be listed separately. We fully realise that this part offers distinct advantages over the Collar in many mechanisms, and we are therefore going into the question of supplying this part separately. A further announcement on this suggestion will appear shortly. (*Reply to A. E. Spence, Manchester; R. B. Gorton, Hove; and many others*).

IRON ARMATURE.—We note that whilst constructing the Meccano Bell (see June "*M.M.*", page 515) you have felt the need of a plain strip of soft iron that could be used as an armature. We have noted your suggestion. (*Reply to E. Cramner, Sunderland*).

OVAL PLATES.—It would be practically impossible to find any use for oval plates of the type that you suggest. We think you will agree that almost all engineering structures are built up in the form of either circles or rectangles, and that the ellipse does not enter into the design of machinery, etc., to any great extent. (*Reply to E. Wilmot, Port Elizabeth, S. Africa*).

1" DUNLOP TYRES.—Specially moulded Dunlop Tyres for use in conjunction with the 1" Pulley Wheel are unnecessary additions to the system. We would point out that a ⅜" Rubber Ring is already supplied for fitting to the 1" Pulleys, and we may say that this Ring gives the wheel quite a realistic appearance when used on model motor cars. The Ring is moreover, particularly useful in the construction of frictional driving mechanisms. (*Reply to A. MacDonald, Belfast*).

IMPROVED FLANGED PLATE.—Your suggestion that the slot found in the new style 2½" × 5½" Flanged Plate, should be widened, is interesting. The slot was originally cut so as to allow the blade of the Circular Saw to be fitted but it is possible to slip a Strip through the slot and so control mechanisms hidden behind the Flanged Plate. The slot will not however, admit the reversing lever of the Clockwork Motor. This suggestion is quite interesting and will be considered in due course. (*Reply to D. McLean, Manchester*).

LARGER SECTOR PLATES.—Uses for a larger pattern of the Sector Plate could not be easily found as the existing Sector Plate generally fulfils all the requirements of a part of this nature. (*Reply to D. M. McLean, Manchester*).

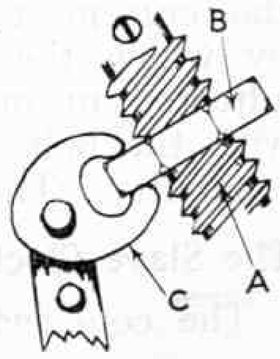
COMBINED GEAR WHEEL AND PULLEY.—We have inspected your sketch of a suggested internal-teeth gear wheel but we are unable to pass a favourable opinion upon it. The uses to which a combined wheel of this type could be put are few and we cannot consider your idea further. (*Reply to Fred Pole, Beckenham*).

NEW 2½" × 3½" FLANGED PLATE.—Your suggestion regarding fitting the 2½" × 3½" Flanged Plate with four flanges is interesting. However, while considerable advantage has been gained in adding two flanges to the 5½" × 2½" Plate we do not consider that it would be advisable to alter the smaller Flanged Plate in a similar manner as the extra flanges in this case would tend to hinder its adaptability rather than increase it. (*Reply to D. McLean, Manchester*).

IMPROVED CLOCKWORK MOTOR.—We note that you advocate a reduction in the weight of the Clockwork Motor. This would certainly be an improvement although it would be difficult to reduce the Motor's weight without sacrificing some of its rigidity, power, etc. We are at the present experimenting with a view to introducing an improved form of clockwork motor but whether the improved motor will be lighter than the present one we are unable to say. It can be definitely stated however that if a new motor is introduced, it will be considerably more compact and efficient. (*Reply to P. Pritchard, Clapham Common, S.W.11*).

NEW TYPE ROD.—Your suggestion that a series of Rods having at each end a flattened and drilled portion, should be introduced is of considerable interest. We doubt, however, whether your idea is practicable because if the end of the existing Axle Rod were flattened as you suggest, it would be practically impossible to drill standard holes in the flattened portion. The only alternative would be to increase the width of this portion and then of course the Rod could not be passed through standard holes in plates, etc. For use as a tie rod your suggested part has, however, distinct possibilities. (*Reply to E. G. W. Williams, Hampton Hill, Middlesex*).

WORM AND NUT MECHANISM.—A worm and nut gear is certainly an interesting mechanism but we were surprised to hear that you are unable to reproduce it with Standard Meccano parts. From the sketch the principle of this form of gear will be understood. The worm A is mounted on a rod which can be turned by hand; the "nut" B rides up and down the worm, pulling with it the fork C and the lever operating the mechanism, which might, for example, comprise a Jeantend steering linkage. Although we agree that a special "worm and nut" might simplify the construction of this gear, we see no reason why Meccano boys should not reproduce it from a few existing parts, i.e., Screwed Rods, Threaded Bosses, etc. We would be pleased to receive particulars from readers of the way in which they have devised this gear while using standard parts. (*Reply to R. T. Hedges, Nottingham*).



ADDITIONS TO THE MECCANO SYSTEM

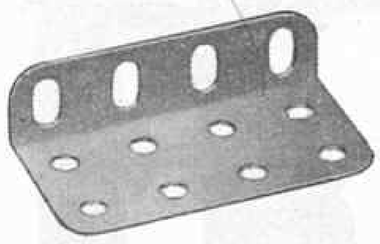
No. 36b, Special Screwdriver

Here is a screwdriver that will please the Meccano boy who is continually screwing up nuts and bolts! It is of all-metal construction, and the shaft is fitted to the handle in such a way that it is impossible for the one to turn round without the other, as is frequently the case with even the best screwdrivers. The shaft will pass completely through the standard Meccano hole—a fact that considerably simplifies the construction of intricate models.



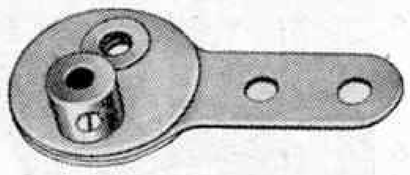
Length overall: 8" (shaft 5" long). Handle milled deeply so that a firm grip may be obtained. Price 1/- each.

No. 161, Girder Bracket



This part resembles a 2" Flat Girder with a ½" Flange attached to one side. It will prove extremely useful in any form of Meccano construction, but especially in the construction of bearings for shafting, etc. It is particularly suitable for bolting to the sides of Motors. Price 3d. for two.

No. 170, Single-throw Eccentric



This part will prove invaluable in many cases where the existing Triple-throw Eccentric would be unsuitable on account of its size. It provides a "throw" of ½", or a "travel" or reciprocating movement of ½". Examples of its use will be found in the Meccano Traction Engine, the description of which is concluded in this issue, and in the Roundabout, which was illustrated on page 664 of the August "*M.M.*" The price of the Single Throw Eccentric is 9d.

Oil Can (type No. 1)



This Oil Can will form a convenient means with which to lubricate Meccano mechanisms or Hornby locomotives. It is of nickelled brass and is provided with raised side panels, on pressing which the oil is expelled in drops. Price 6d. each.

Meccano Enamel

The Meccano enamel has been introduced to enable model-builders to convert nickelled parts to coloured or to touch up coloured parts should such treatment become necessary through mishandling. It is available in red and green, each colour identical in shade with the enamels used in the Meccano factory for spraying Meccano parts. It is supplied ready for use and should be applied to the Meccano parts thinly with a small brush. The parts should first be cleaned thoroughly, of course, dirt or rust being removed carefully. The enamel is of the finest quality and gives a beautiful finish. Price 8d. per tin, either colour.



Electricity Applied to Meccano

XIII—Meccano Electric Time-Keeping Apparatus

These articles are intended to draw every Meccano boy's attention to the numerous fascinating uses to which the Meccano Electrical parts may be put. The first two articles of the series dealt with the elementary principles of electricity, and subsequent articles described Meccano switches, a coil winding machine, a telegraph system, electro magnets, a galvanometer, motors, an electric locomotive, bells, lamps, an ammeter, an electric sign, an electrically-controlled railway, electric beam and horizontal engines, a drop hammer, and a remote control for radio sets. This month we describe a means whereby the Meccano Grandfather Clock may easily be caused to control any number of "slave clocks." Thus the Meccano boy may now have an accurate time-keeper in every room in his house.

THE interest and practical value of the Meccano Grandfather Clock, which is already regarded by most boys as one of the finest Meccano models, may be increased still further by using it as an electric master clock. When so adapted the clock may be made to control any number of electric dials, or "slave clocks," situated in different rooms or even in different buildings, the only connection between the dials and the clock being two insulated wires.

The Meccano Clock is converted to an electric master clock merely by attaching an automatic switch mechanism. This is shown in Fig. 1, and is constructed as follows. The Rod 1 of the clock mechanism proper is normally 3" long, but this must be exchanged for a 3½" Rod to allow a 57-teeth Gear Wheel to be added to the inner end. This Gear Wheel drives the ½" Pinion 2 on the 2" Rod 3, which also carries a 2" Sprocket Wheel 4. As will be seen, one side of the Sprocket Wheel is covered with a circle of thin card (a postcard serves excellently) attached to the wheel by the two bolts 5.

The 5½" Strip 6 carries a 1" Triangular Plate 7 and two Terminals 8 and 9, the former (8) being bolted direct to the Strip 6 while the terminal 9 is insulated therefrom by an Insulating Bush and Washer. A short length of No. 22 bare copper wire is fastened to the terminal 9 and to the insulated 6 B.A. Bolt 10 on the Triangular Plate 7. The wire is bent inward to touch the card on the Sprocket Wheel 4, and its length is such that as this wheel revolves, the bolts 5 just brush against its end and thus switch on the current to work the slave clocks. The length by which the wire overlaps the Wheel 4 should be adjusted in order to make the duration of contact with the bolts 5 as short as possible, consistent with reliability. The points of contact must be kept clean.

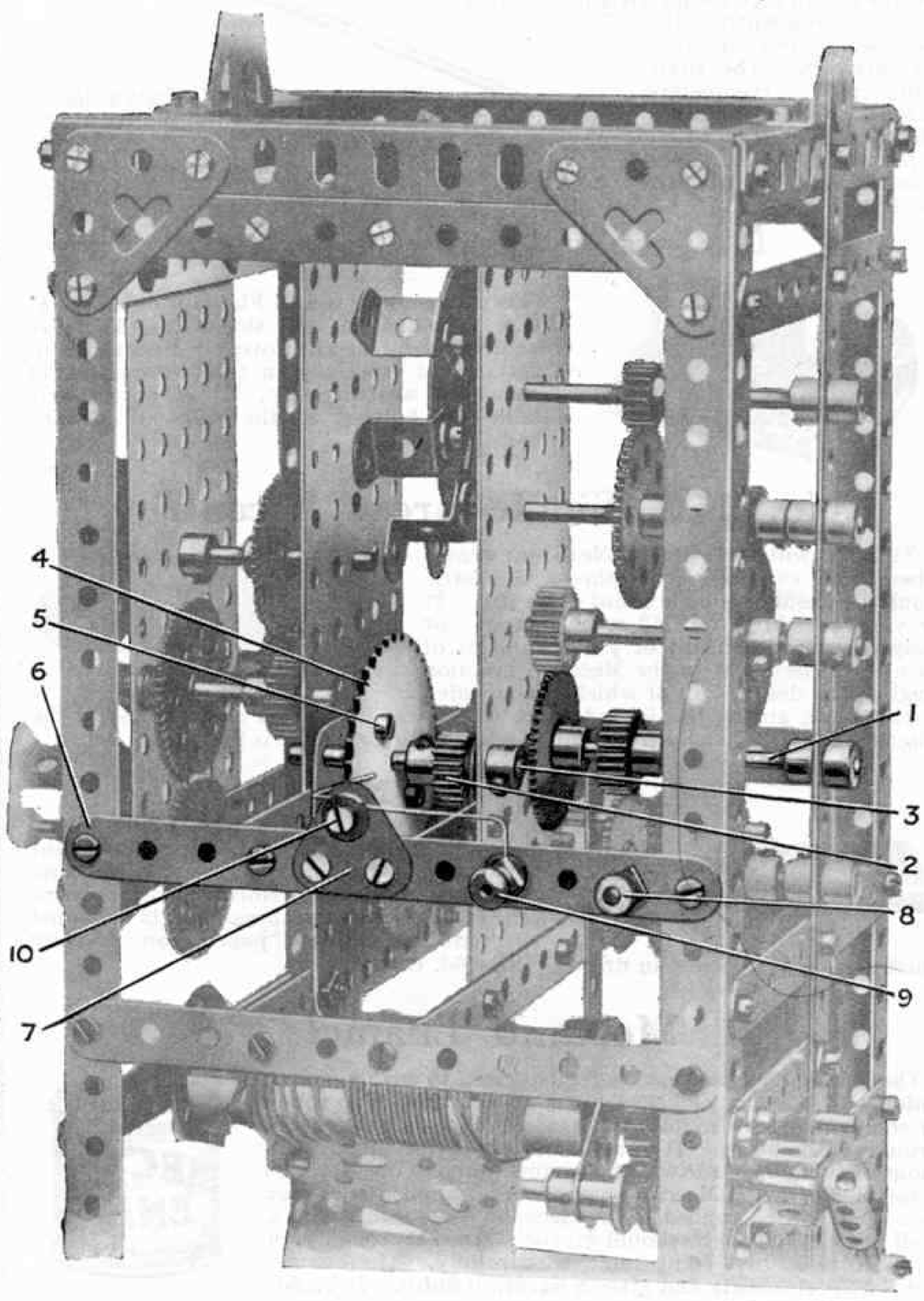


Fig. 1. The Meccano Grandfather Clock mechanism, showing the electric Master Control

The Slave Clock Mechanism

The construction of the slave clock will be fairly clear on reference to Figs. 2 and 4. Fig. 2 is a general view and Fig. 4 is a view of the mechanism at the rear. The frame of the slave clock consists of a 5½" × 3½" Flat Plate 11 (Fig. 4) and a 5½" × 2½" Flat Plate 12 connected together at the top by two 2½" × ½" Double Angle Strips and a 3½" Angle Girder, and at the bottom by two 3½" Angle Girders and two 3½" × ½" Double Angle Strips, in the end holes of which are bolts by which the model may be secured to, say, a wall bracket.

The electro magnet consists of two Bobbins 13 wound to capacity with No. 26 gauge S.C.C. wire and supported by a 1½" × ½" Double Angle Strip 14, between which and the Bobbins are placed four 1½" Strips.

The propelling arm 15 consists of a 3½" Strip, to the bottom end of which is attached a Boss Bell Crank carrying the counterweight 16 that comprises two Threaded Bosses and two 1½" Strips secured to a 1" Screwed Rod. A 3½" Rod 17 is secured in the boss of the Bell Crank and upon this Rod the arm pivots. The armature 18 consists of four 1½" Strips attached by an Angle Bracket to the propelling arm 15.

A Pawl 19 attached by means of a Pivot Bolt to the top hole of the propelling arm engages with the teeth of the 2" Sprocket Wheel 24. The latter is prevented from turning backward by the second Pawl 25 that is pivoted on a 1" Rod fixed in the boss of the Crank 26. The back stop for the propelling arm is adjustable. It is formed by bolting a Crank 20 to the Flat Plate 11 so as to support a 1" Rod that carries on its outer end a Coupling 21, through which is threaded a 1" Screwed Rod 22. When the correct position for the stop has been found the Rod 22 is locked in position by the Threaded Boss 23.

The inner ends of the wires on the Bobbins 13 are fastened together by a nut and bolt and two Washers 27, and the outer ends are taken to the two Terminals 28 and 29, the latter only being insulated. Care must be taken to ensure that the bolt 27 does not come into

contact with the frame of the model.

How the Slave Clock Operates

When the current is switched on by the automatic switch on the master clock, the magnets 13 attract the armature 18, thus causing the Pawl 19 to move forward and propel the Sprocket Wheel 24 one tooth forward. When the current is switched off, the armature is released and the propelling arm 15, with the Pawl 19, is returned by the counter-weight 16 to its normal position against the back stop 22. It will thus be seen that the Wheel 24 is turned by the action of the pulses of current received by the magnets from the master clock.

The Rod 30, to which the Wheel 24 is attached, carries a ¾" Pinion 31 that meshes with a 50-teeth Gear Wheel 32 on the 4½" Rod 33, to which the minute hand 34 is attached. The hands are made of cardboard, for Meccano Strips prove too heavy for the purpose.

The hour hand is driven by the minute hand through gears arranged similarly to those on the master clock. A ¾" Pinion on the Rod 33 drives a 50-teeth Gear Wheel on the Rod 35, which carries a ½" Pinion that, in turn, drives the 57-teeth Gear 36. This Wheel meshes with another 57-teeth Gear 37 on the same Rod as the ¾" Pinion 38, and the latter engages with the 50-teeth Gear 39 on the Rod of the 1½" Sprocket Wheel 40, which drives the hour hand as shown. The ½" Reversed Angle Bracket that carries the hour hand is separated from the Sprocket Wheel, which is loose on the Rod 33, by two Washers to provide the necessary clearance for the Sprocket Chain.

The face of the slave clock may be attached to the four Double Angle Strips 41, and the whole mechanism may be mounted in any suitable frame.

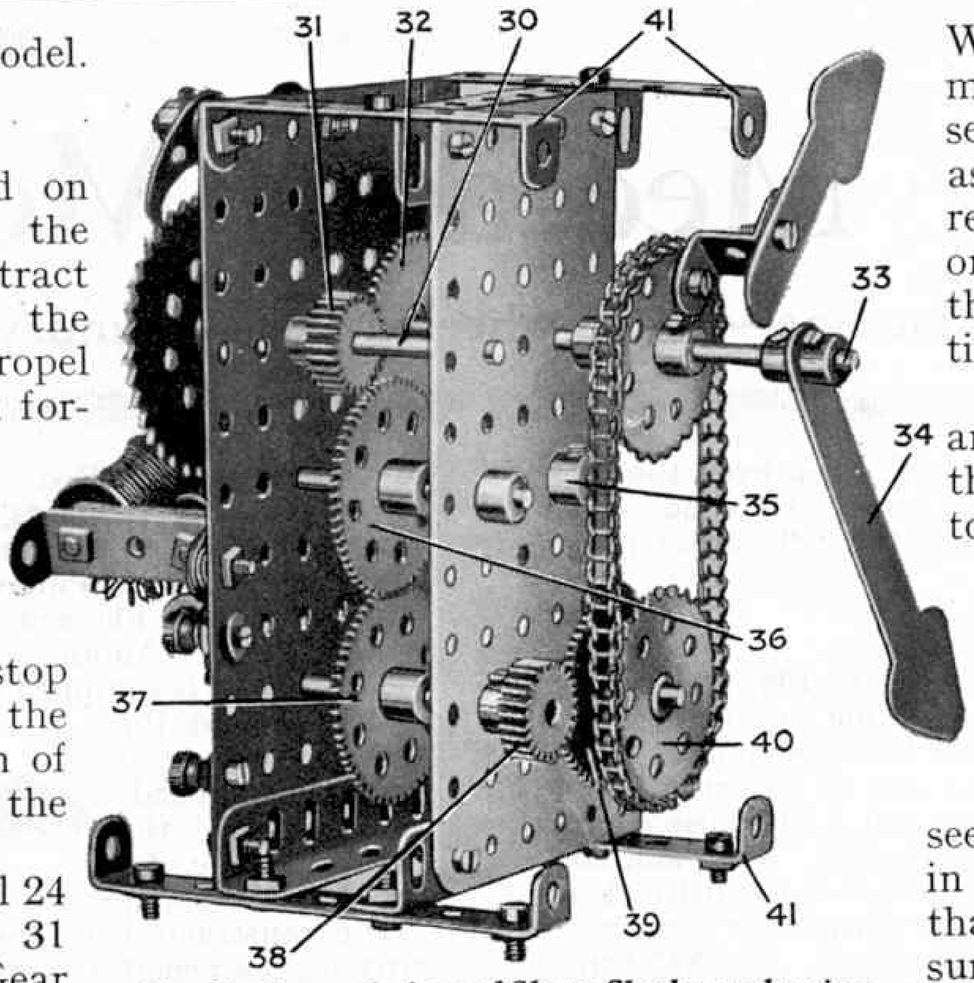


Fig. 2. General view of Slave Clock mechanism

Wiring Details

The wiring of the master clock, slave clock, and Accumulator is very simple. One wire is taken from the Terminal 8 on the clock (Fig. 1) to one terminal of the Meccano 4-volt Accumulator. Another wire is taken from the other terminal of the Accumulator to the Terminal 28 on the slave clock, and a third wire is taken from the Terminal 29 to the Terminal 9 on the master clock. Thus every time one of the Bolts 5 comes into contact with the wire from the Terminal 9, the Wheel 24 of the slave clock is moved on one tooth. This happens seventy-two times every hour and as this is the number of impulses required to turn the minute hand on the electric dial round once, the master clock and dial keep time with each other.

The slave clock may be placed anywhere, its only connection with the clock being the two wires to carry the current. Any number of slave clocks may of course be controlled by the one master clock. (A convenient method of wiring three slave clocks to a master clock is indicated in Fig. 3, where it will be seen that the clocks are connected in parallel. This means of course, that more current will be consumed than is the case when only one slave clock is employed). The Meccano 4-volt 8 amp. Accumulator is quite suitable to operate a single slave clock. With a number of slave clocks connected in parallel, however, it is necessary to use the 4-volt 20 amp. Accumulator.

It is of the utmost importance that all the moving parts of both the slave and master clocks should work with perfect freedom. All the bearings should be in alignment so that the gears mesh correctly, and, of course, the mechanism should be kept well oiled.

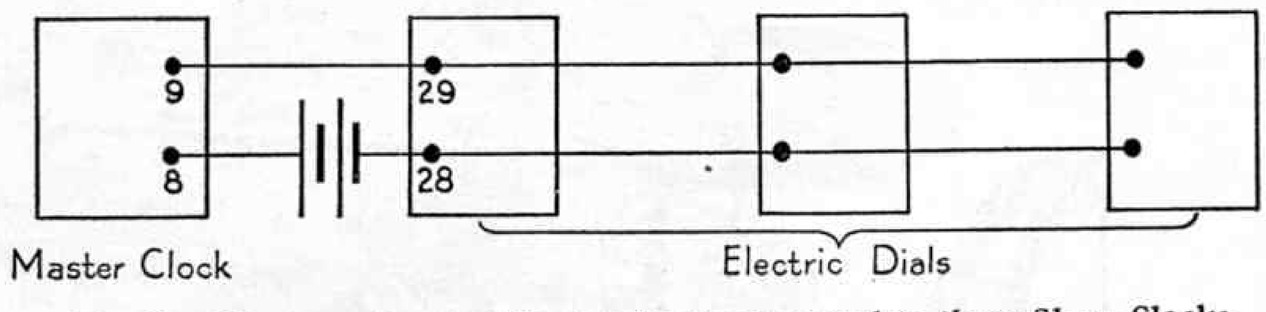


Fig. 3. Diagram showing Master Clock connected to three Slave Clocks

Parts Required for Electric Mechanism

The automatic switch mechanism requires the following parts extra to the ordinary parts embodied in the Grandfather Clock :—

1	of	No.	16	1	of	No.	78
1	„	„	17	1	„	„	95
1	„	„	26	2	„	„	302
1	„	„	27A	2	„	„	303
4	„	„	37	3	„	„	304
2	„	„	38	3	„	„	305
1	„	„	59	2	„	„	306
				3″	„	„	315

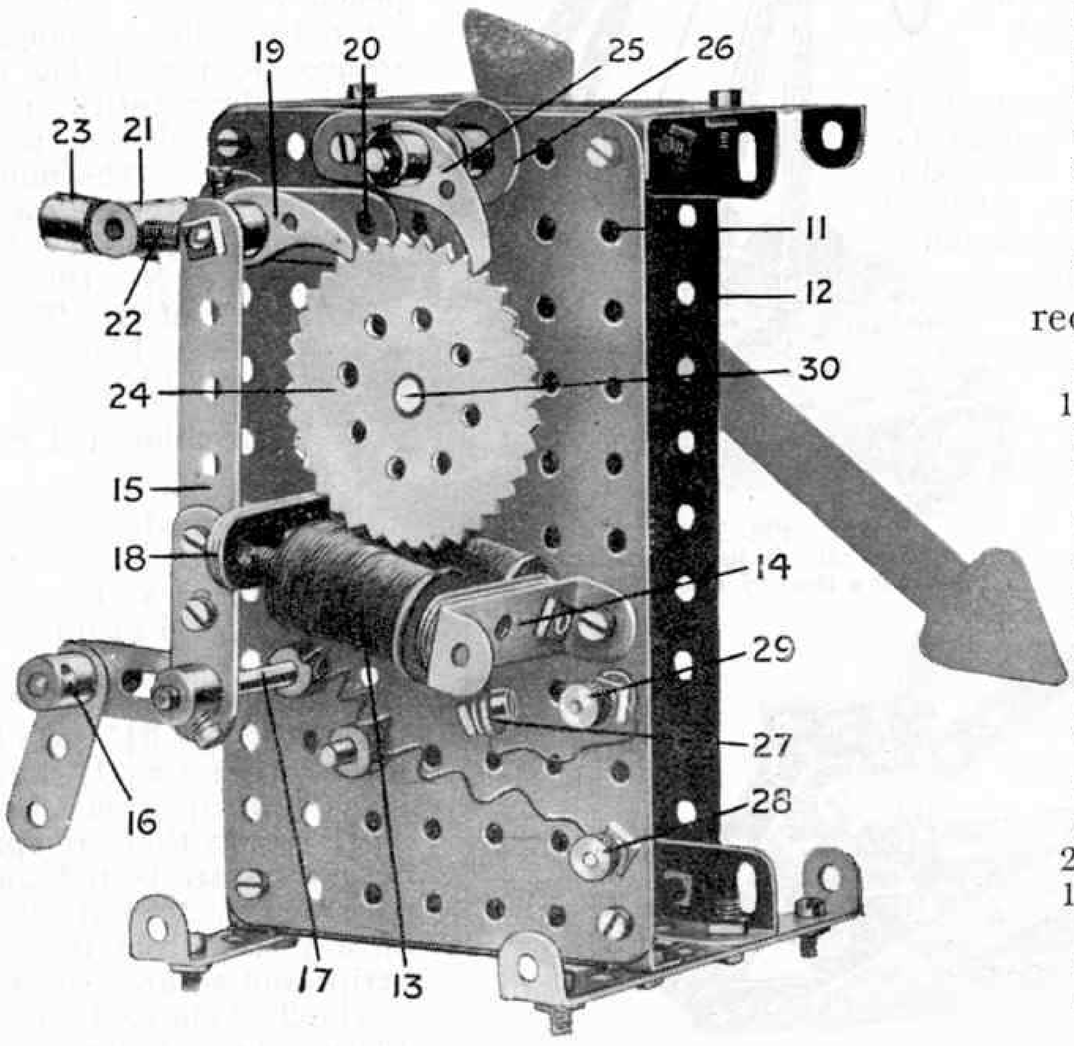


Fig. 4. Rear view of Slave Clock showing electro magnet, etc.

The slave clock mechanism requires the following parts:—

1	of	No.	3	13	of	No.	59
10	„	„	6A	2	„	„	62
3	„	„	9B	1	„	„	63
1	„	„	12	3	„	„	64
1	„	„	15A	1	„	„	70
1	„	„	16	2	„	„	82
1	„	„	16A	10″	„	„	94
1	„	„	16B	1	„	„	95
3	„	„	17	2	„	„	95A
2	„	„	18B	1	„	„	125
3	„	„	25	1	„	„	128
1	„	„	26	2	„	„	147
3	„	„	27	2	„	„	301
2	„	„	27A	1	„	„	302
29	„	„	37	1	„	„	303
10	„	„	38	2	„	„	304
1	„	„	48	2	„	„	305
2	„	„	48A	2	„	„	306
2	„	„	48B	2	„	„	308
1	„	„	52A	1	„	„	313

1 Clock Face
2 Cardboard Hands

New Meccano Models

Monoplane—Designing Machine—Three-wheeled Car—Foundry Ladle—High Chair, etc.

HERE are eight more models that should keep even the most energetic constructor occupied for some little time. Each model consists of only a few parts but will afford plenty of fun when completed.

A Realistic Meccano Monoplane

The well proportioned little model shown in Fig. 1 resembles the monoplane "Spirit of St. Louis," a machine that Col. Charles Lindbergh has made world famous. The fuselage consists essentially of two 5½" Strips spaced apart at one end by means of Double Brackets and bolted together at the other end. The nose is built up from 2½" Curved Strips bolted one to each 5½" Strip and connected to the tail end of the fuselage by 2½" Strips and Flat Brackets.

The undercarriage is composed of two 2½" Strips that form bearings for a 1½" Axle Rod carrying two 1" Pulleys. Six 5½" Strips are bolted together as shown (being secured at their outer ends by means of Flat Trunnions) to form the wings, which are then bolted to a 3½" Strip, and the latter, in turn, is secured to the Double Brackets of the fuselage. The tail plane is built up from a 3½" Strip and two 2½" Strips bolted to the fuselage by means of Angle Brackets. The propeller is secured to a 2" Axle Rod that is journalled in Angle Brackets bolted to the 3½" Strip of the fuselage. The construction of the remainder of the model does not require description as it is shown clearly in Fig. 1.

The parts necessary to build the Meccano monoplane are: 8 of No. 2; 2 of No. 3; 8 of No. 5; 4 of No. 10; 2 of No. 11; 5 of No. 12; 1 of No. 17; 1 of No. 18a; 2 of No. 22; 1 of No. 24; 40 of No. 37; 3 of No. 90a; 2 of No. 126a.

Miniature Meccanograph

The Meccanograph is a model that every keen Meccano boy would like to build, but all of us are not so lucky as to have the necessary parts with which to build the machine as it is illustrated in the Instructions Manual. There is no reason, however, why everyone should not obtain a considerable amount of pleasure and amusement from the "baby Meccanograph" illustrated in Fig. 2.

The frame of the model consists of two 5½" Braced Girders bolted to the side flanges of a 5½" × 2½" Flanged Plate. A 3½" Axle Rod is mounted on each side of the Flanged Plate by means of Angle Brackets and Spring Clips, and a Double Bracket is free to slide along each Rod. A 2½" Strip is now bolted at each end to these Double Brackets, Washers being placed between the bolt heads and Strip to prevent the bolts fouling the Axle Rods. The designing table (a 3" Pulley Wheel) is secured to a 2" Axle Rod that is journalled in a Flanged Trunnion and a 2½" Strip and carries a 1" Pulley Wheel. Another 2" Rod journalled in the Flanged Plate is equipped with a Bush Wheel and a 1" Pulley, and the latter is connected by means of an endless cord to the Pulley on the designing table spindle.

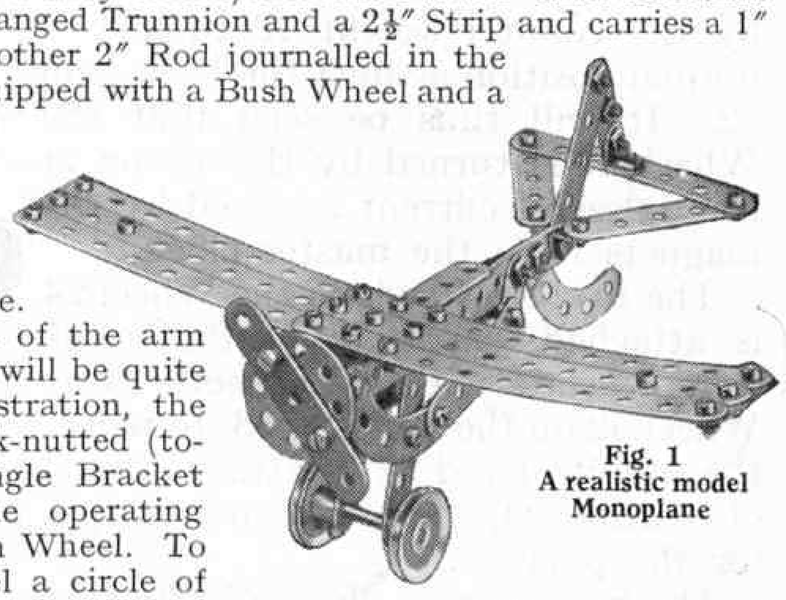


Fig. 1
A realistic model Monoplane

The construction of the arm carrying the pencil will be quite clear from the illustration, the 3½" Strip being lock-nutted (together with an Angle Bracket that serves as the operating handle) to the Bush Wheel. To complete the model a circle of stiff cardboard should be attached to the face of the 3" Pulley, so as to provide a smooth surface on which the pencil may travel.

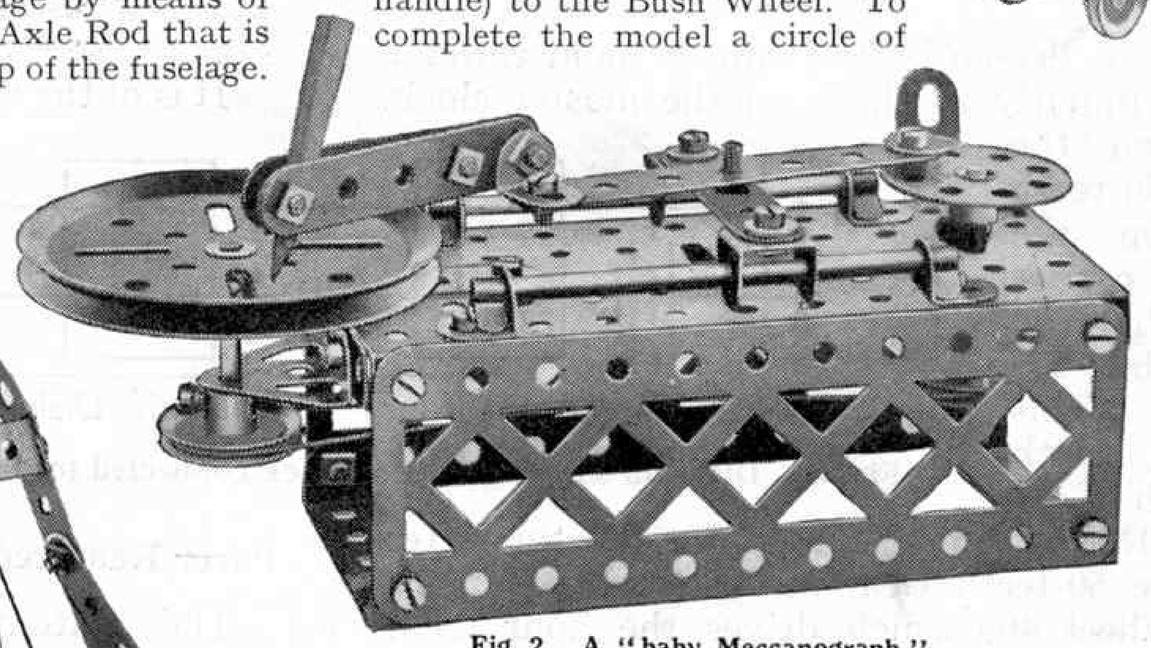


Fig. 2. A "baby Meccanograph"

The model is operated as follows. A piece of paper is secured to the table by means of paper-clips or drawing pins, and a pencil or stylo-pen is placed between the two 2½" Strips of the arm and clamped by a bolt and nut. On rotating the Bush Wheel by means of the Angle Bracket, the pencil will trace out a geometrical design. The pattern can be altered at will by changing the position of the arm on the ⅜" Bolt secured to the sliding platform, and further variations may be obtained by substituting different sizes of wheels for the 1" Pulleys driving the table.

The miniature Meccanograph is constructed from the following parts: 1 of No. 3; 4 of No. 5; 2 of No. 11; 6 of No. 12; 2 of No. 16; 2 of No. 17; 1 of No. 19b; 2 of No. 22; 1 of No. 24; 5 of No. 35; 21 of No. 37; 2 of No. 37a; 2 of No. 38; 2 of No. 48a; 1 of No. 52; 2 of No. 100; 3 of No. 111c; 2 of No. 126.

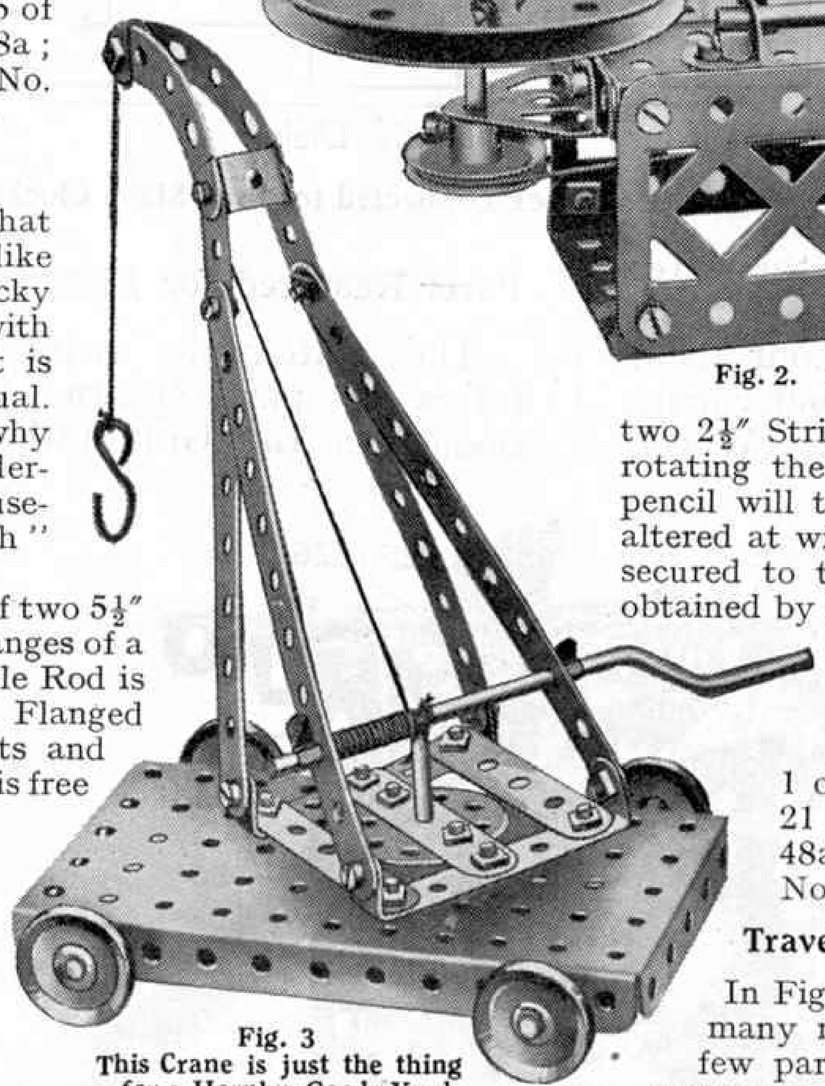


Fig. 3
This Crane is just the thing for a Hornby Goods Yard

Travelling and Rotating Crane

In Fig. 3 will be seen a Meccano crane that should appeal to many model-builders, since it is very realistic and requires few parts for its construction. If the builder is the lucky possessor of a Hornby Railway, he will find the crane of considerable use in loading miniature merchandise into goods wagons, etc.

The travelling base of the model consists of a 5½" × 2½" Flanged Plate with two 3½" Axle Rods journalled in the side flanges. Each Axle carries two 1" Pulleys which form the road wheels. The jib is built up from four 5½" Strips bolted to two 2½" × ½" Double Angle Strips that are spaced apart by means of 2½" Strips. The 5½" Strips are bolted together in pairs and their upper ends are extended by 2½" Curved Strips. A ½" loose Pulley is free to rotate on a ⅜" Bolt that is passed through the ends of the 2½" Curved Strips and secured by means of lock-nuts.

The 2" Axle Rod on which the jib revolves is journalled in the Plate and in a ½" Reversed Angle Bracket bolted beneath the Plate. To complete the model a Crank Handle is journalled in the 5½" Strips and a cord passed from this, round the Pulley at the end of

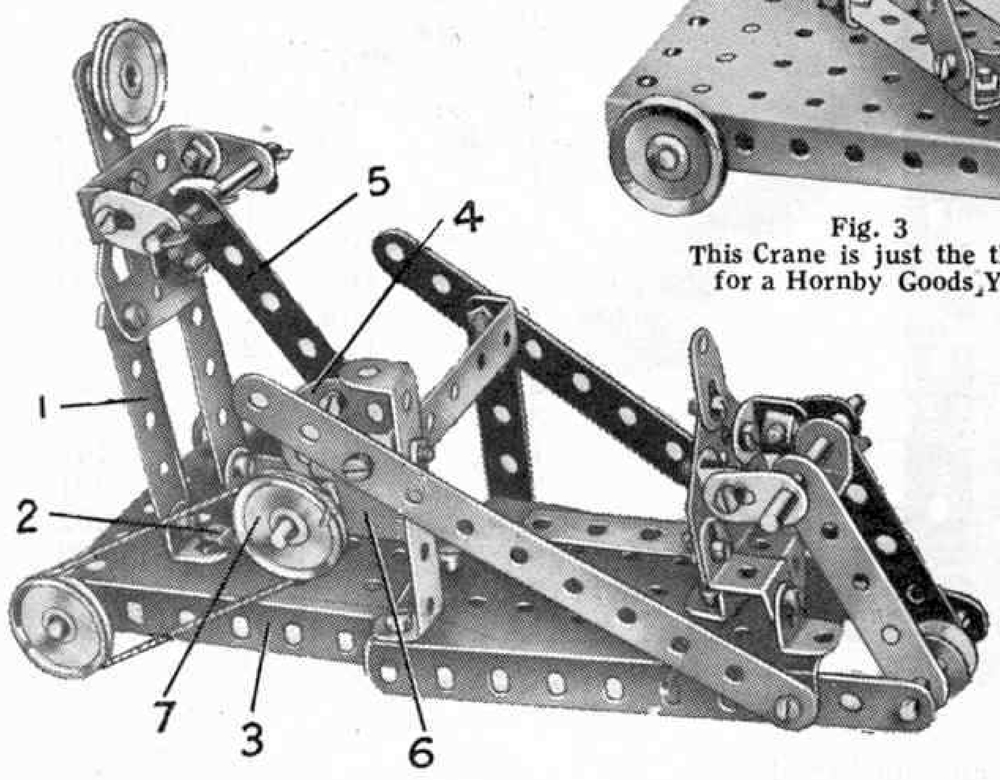


Fig. 4. Coaster; a very amusing working model

the jib, and secured to the hook.

The parts required to build this model are: 4 of No. 2; 3 of No. 5; 1 of No. 11; 2 of No. 16; 1 of No. 17; 1 of No. 19s; 4 of No. 22; 1 of No. 23; 1 of No. 24; 2 of No. 35; 17 of No. 37; 1 of No. 37a; 2 of No. 48a; 1 of No. 52; 1 of No. 57; 2 of No. 90a; 1 of No. 111c; 1 of No. 125.

Coaster, complete with Driver and Passenger

The peculiar vehicle seen in Fig. 4 cannot fail to raise a laugh when it is pushed along the floor, for the individual mounted at the rear rocks himself violently to and fro as if endeavouring to propel the machine.

The construction of the model is quite simple. Begin by bolting the two Sector Plates together and securing two 2½" Strips in the front to form bearings for a 1½" Axle Rod that carries a ½" loose Pulley. A 3½" Axle Rod should next be journalled in the side flanges of the Sector Plate 3 and fitted with a 1" fast Pulley on each end. One of these Pulleys is connected by means of cord to the Pulley 7, which is secured to a 2" Axle Rod journalled in a Cranked Bent Strip 6. This Axle Rod also carries the Bush Wheel 4.

The "Meccanitian" 1 is attached loosely to the Sector Plate by means of Angle Brackets and lock-nutted bolts 2. His legs—2½" Strips—are secured to a Flat Trunnion to which a 2½" Strip and a 1½" × ½" Double Angle Strip also are bolted. The former carries a 1" Pulley, which represents his head, and Flat Brackets are secured to the latter to form his arms. The Strip 5 is attached pivotally to the latter by means of a 2" Axle Rod and Spring Clips, its other end being lock-nutted to the Bush Wheel 4. The "passenger" seated at the front of the model is built up from a Flat Trunnion, to which a Flat Bracket is bolted to form the head. His arms consist of Flat Brackets which are secured to the Trunnion by means of Angle Brackets, and his legs are composed of Angle Brackets and ½" Reversed Angle Brackets.

The following are the parts required to build the coaster: 2 of No. 2; 9 of No. 5; 5 of No. 10; 2 of No. 11; 7 of No. 12; 1 of No. 16; 2 of No. 17; 2 of No. 18a; 4 of No. 22; 1 of No. 23; 1 of No. 24; 8 of No. 35; 37 of No. 37; 6 of No. 37a; 1 of No. 48; 2 of No. 48a; 2 of No. 54; 2 of No. 111c; 2 of No. 125; 2 of No. 126a.

Three-Wheeled Motor Car

The three-wheeled runabout illustrated in Fig. 5, although small, has a distinctly "racy" appearance. The chassis is formed from two 5½" Strips spaced apart by means of the flanges of two Trunnions, and a 2½" × ½" Double Angle Strip bolted across the front axles. The steering wheel consists of a ½" loose Pulley secured by an Angle Bracket to the Bush Wheel.

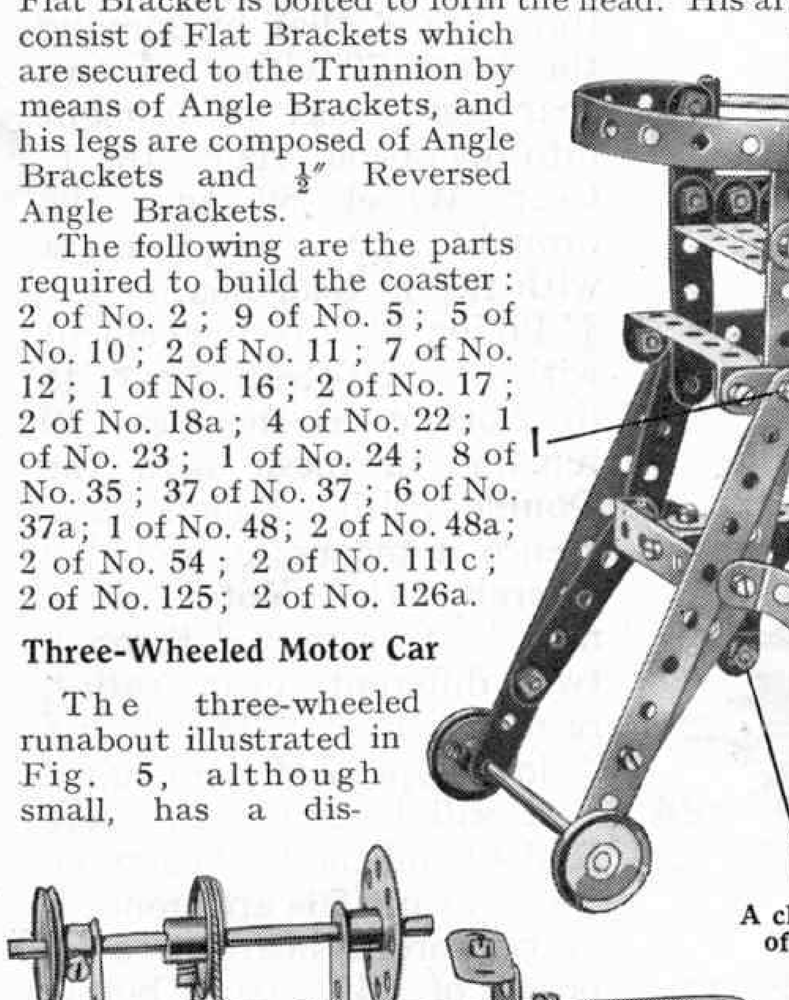


Fig. 7
A cleverly-designed model of a Baby's High Chair

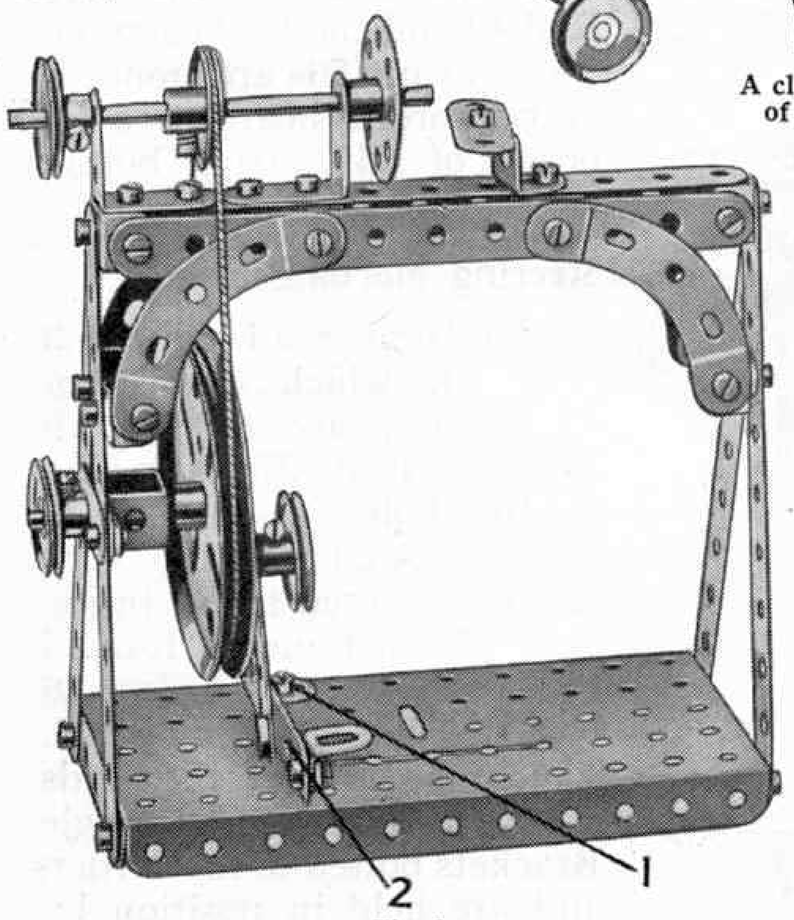


Fig. 8
This model Lathe may be operated by the treadle attached to the base plate

Much fun could be obtained by building several of these models and organising races. The models must of course be placed on an incline so that they may travel under their own weight.

Parts required to build the three-wheeler: 2 of No. 2; 2 of No. 5; 2 of No. 10; 6 of No. 12; 1 of No. 16; 1 of No. 17; 3 of No. 22; 1 of No. 23; 1 of No. 24; 15 of No. 37; 1 of No. 37a; 2 of No. 48a; 1 of No. 111c; 2 of No. 126.

Giant Foundry Ladle

Nowadays iron and steel play an all-important part in almost every branch of engineering. Fig. 6 shows a Meccano model of a giant ladle of a type that is used in foundries for handling molten iron.

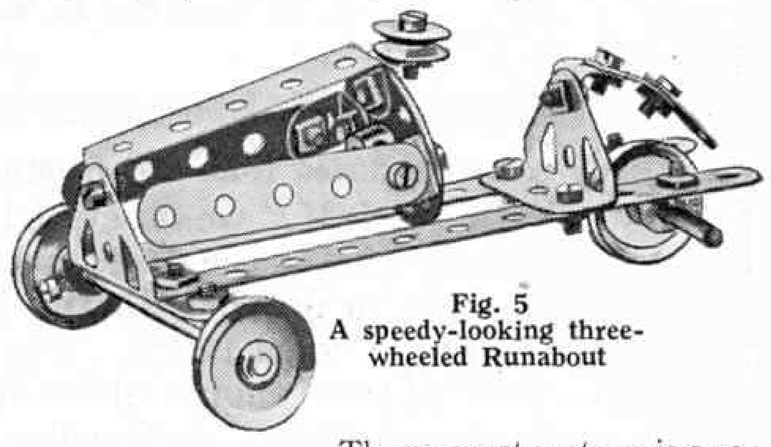


Fig. 5
A speedy-looking three-wheeled Runabout

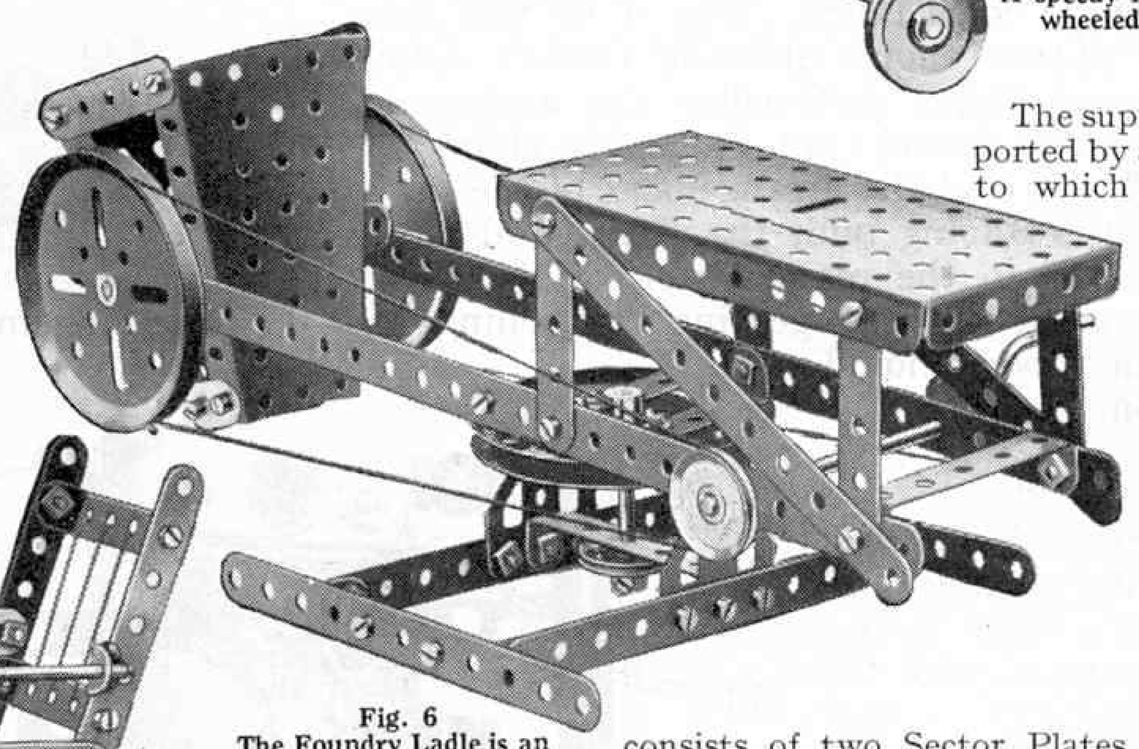


Fig. 6
The Foundry Ladle is an accurate reproduction of its prototype

The superstructure is supported by a 3" Pulley Wheel, to which is attached two 2½" × ½" Double Angle Strips. The roof of the operating cab is a 5½" × 2½" Flanged Plate fastened to the 12½" Strips by 2½" Strips, which are made rigid by two 5½" Strips bolted diagonally between the shorter Strips. The "ladle" consists of two Sector Plates held together by means of 2½" Strips and Flat Brackets. A 3½" Axle Rod passes through a Bush Wheel and two 2½" Strips, which are bolted to the Sector Plates, and carries a 3" Pulley on each end, these Pulleys being connected by means of cords to 1" Pulleys secured to the Crank Handle, which is journalled in the 12½" Strips. The Bush Wheel is secured to the 3½" Rod; hence, on rotating the handle the ladle can be made to deposit its contents.

The Meccano foundry ladle may be built from the following parts: 2 of No. 1; 6 of No. 2; 7 of No. 5; 2 of No. 10; 1 of No. 16; 1 of No. 17; 3 of No. 19b; 1 of No. 19s; 3 of No. 22; 1 of No. 23; 1 of No. 24; 36 of No. 37; 6 of No. 37a; 7 of No. 48a; 1 of No. 52; 2 of No. 54; 6 of No. 111c; 2 of No. 126a.

Baby's High Chair

This model (Fig. 7) should appeal particularly to our numerous girl readers, for they will doubtless find it a real help in teaching their dolls proper table manners!

The construction of the chair will be fairly clear from the illustration. The legs are built up of 5½" Strips strengthened by 2½" Strips and spaced apart by means of 2½" × ½" Double Angle Strips. The bolts 1 are pivotally secured by means of lock-nuts (see Standard Mechanisms Nos. 262 and 263). The back consists of two 5½" Strips connected by two Double Angle Strips, while the seat is built up from three Double Angle Strips; a similar strip also forms the foot-rest.

A 5½" Strip is curved to form the "table" and is connected to the back of the model by means of Axle Rods passed through Angle Brackets and secured by Spring Clips. The height of the model can be adjusted by passing any hole of the Strip 2 over the shank of a bolt secured to the Double Angle Strip 3 by an Angle Bracket.

The parts required to build the baby's high chair are: 8 of No. 2; 2 of No. 3; 12 of No. 5; 6 of No. 12; 2 of No. 16; 2 of No. 17; 4 of No. 22; 4 of No. 35; 35 of No. 37; 2 of No. 37a; 4 of No. 38; 8 of No. 48a; 4 of No. 90a; 1 of No. 115.

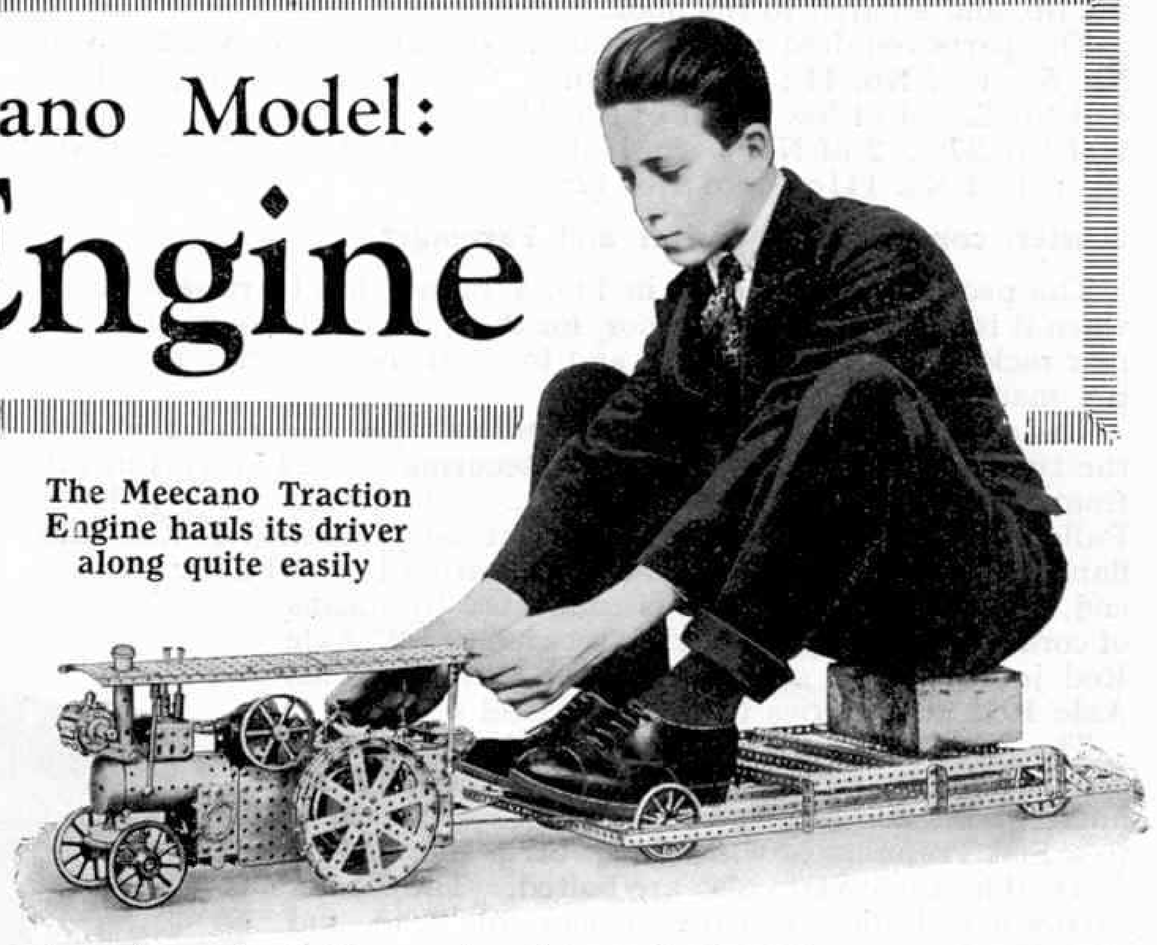
A useful little Treadle Lathe

Fig. 8 shows a neat model of a lathe. The 2½" Strip 2, forming the treadle lever, is pivoted at one end to the Angle Bracket 1 and near its centre to a second 2½" Strip. The other end of the latter Strip is mounted on a Threaded Pin secured to the 3" Pulley.

The parts required are: 7 of No. 2; 1 of No. 3; 1 of No. 5; 2 of No. 6a; 4 of No. 11; 6 of No. 12; 2 of No. 12a; 1 of No 16; 1 of No. 17; 3 of No. 19b; 4 of No. 22; 1 of No. 24; 1 of No. 35; 34 of No. 37; 2 of No. 37a; 4 of No. 38; 1 of No. 45; 1 of No. 52; 4 of No. 90a; 1 of No. 115; 1 of No. 125.

A Powerful New Meccano Model:

Traction Engine



The Meecano Traction Engine hauls its driver along quite easily

(Concluded from last month)

IN last month's "*M.M.*" we described the construction of the main frame of the Meccano Traction Engine, and also dealt in detail with the Boiler and Motor unit and the brake mechanism. Fig. 4 in this issue is a plan view of the engine showing further details of the gearing and Motor unit, while the underneath view of the complete model (Fig. 5) clearly shows the position of the Motor and the arrangement of the brake and steering gear. Having built the Boiler and Motor unit and secured it to the rear portion of the model as described last month, the gearing controlling the movement of the model should receive attention.

The Main Gear Train

The main gear train is included in Fig. 4 but its arrangement will become more clear by referring to the illustration of the motor unit (Fig. 2 in last month's "*M.M.*"). The armature spindle of the Motor (48a in the latter illustration) carries a $\frac{1}{2}$" Pinion 48 that engages with a 57-teeth Gear Wheel 47, on the Rod of which is also carried a $\frac{1}{2}$" Pinion. The latter is secured to the Rod against the inside of the Motor side plate and engages a 57-teeth Gear 49 on the crankshaft 43 (see Figs. 2 and 4).

The crankshaft also carries a $\frac{1}{2}$" Double-width Pinion 21 that meshes with a 57-teeth Gear Wheel 19 secured to a $3\frac{1}{2}$" Rod 42, on which is also secured a 1" Gear Wheel 56 placed against the face of the Gear 19. On the other end of the Rod 42 is a $\frac{3}{4}$" Pinion 44. The Rod is slidable in its bearings and is controlled by the lever 72. The latter is connected pivotally to a Small Fork Piece (shown in Fig. 4 and also in Fig. 3 in the October "*M.M.*") which engages a Collar 42a (Fig. 4) carried on the Rod 42.

A 1" Gear Wheel 56a (Fig. 4) is secured to a $4\frac{1}{2}$" Rod and placed against the outer face of the Motor side plate, and a $\frac{1}{2}$" Pinion 22 and a 50-teeth Gear Wheel 45 are carried at either end of the same Rod. It will be seen from Fig. 4 that by moving the lever 72 either of two gear trains may be brought into operation, viz.:—the 1" Gear Wheel 56 may be brought into engagement with the 1" Gear 56a, or the $\frac{3}{4}$" Pinion 44 into engagement with the 50-teeth Gear 45 (in both cases the Gear 19 remains in mesh with the Double-width Pinion 21). Hence a means is provided whereby the Motor drive may be transmitted through two different gear ratios, resulting in a "fast" and "slow" speed of the engine.

It will be noted that the Rod 42 and the Rod carrying Gears 45 and 56a are mounted in reinforced bearings composed of $1\frac{1}{2}$" Strips bolted to the Motor side plates.

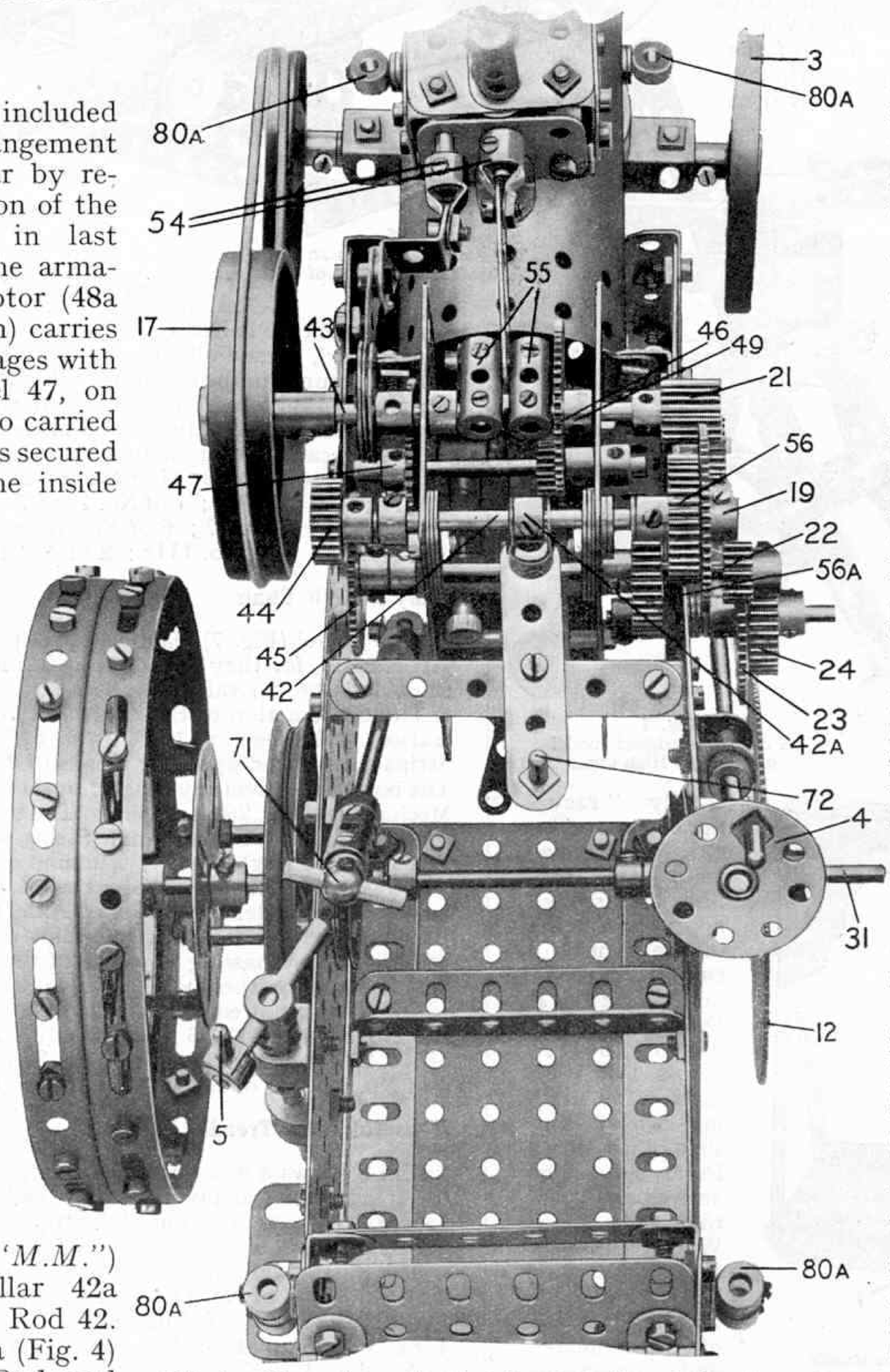


Fig. 4. Plan view, showing Crankshaft and Gearing, etc.

Steering Mechanism

The front road wheels 3 (Fig. 5), which consist of 3" Wheels, are carried on $1\frac{1}{2}$" Axle Rods 27 journalled in the holes of a $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip. The latter is secured to the inside of a channel girder formed by two $3\frac{1}{2}$" Angle Girders 26 bolted together as indicated. The inner ends of the Rods are journalled in Angle Brackets bolted to the Girders and are held in position by Collars secured to the Rods against the faces of the

Angle Brackets. This arrangement is shown quite clearly in Fig. 5.

The Wheel Flange 8 (Fig. 5) is secured to the Girders 26 by bolts passed through a 2″ Sprocket Wheel, and a $1\frac{1}{2}$″ Rod secured in the latter acts as a pivot for the front axle unit. The Rod is journalled in a Double Bent Strip 8a (see Fig. 2 in the October "*M.M.*") bolted to the underside of the Boiler and in the second hole of the Boiler, and is held loosely in position by means of a Collar placed on the Rod inside the Boiler.

The steering mechanism is controlled from a steering wheel 4 (Fig. 4) secured to an 8″ Rod 11 that is journalled in Double Brackets bolted to the side frame plate of the rear portion (see also Fig. 3, October "*M.M.*"). The steering Rod 11 carries at its lower end a Worm 10 (Fig. 5) engaging a $\frac{3}{4}$″ Pinion 9 on a $3\frac{1}{2}$″ Rod 28, which is journalled in $1\frac{1}{2}$″ Strips bolted to the side plates of the framework (see also Fig. 3, October "*M.M.*").

The Rod 28 carries several Couplings and Collars 28a (Fig. 5), the heads of the grub screws of these serving to grip a 16″ length of Sprocket Chain that is wound round the Coupling five or six turns and thence passed round the 2″ Sprocket Wheel attached to the front axle. The ends of the chain are of course joined together. By reason of this arrangement the front wheels may be directed either to right or left according to the direction in which the steering wheel is turned. This steering gear closely follows the method used in actual practice.

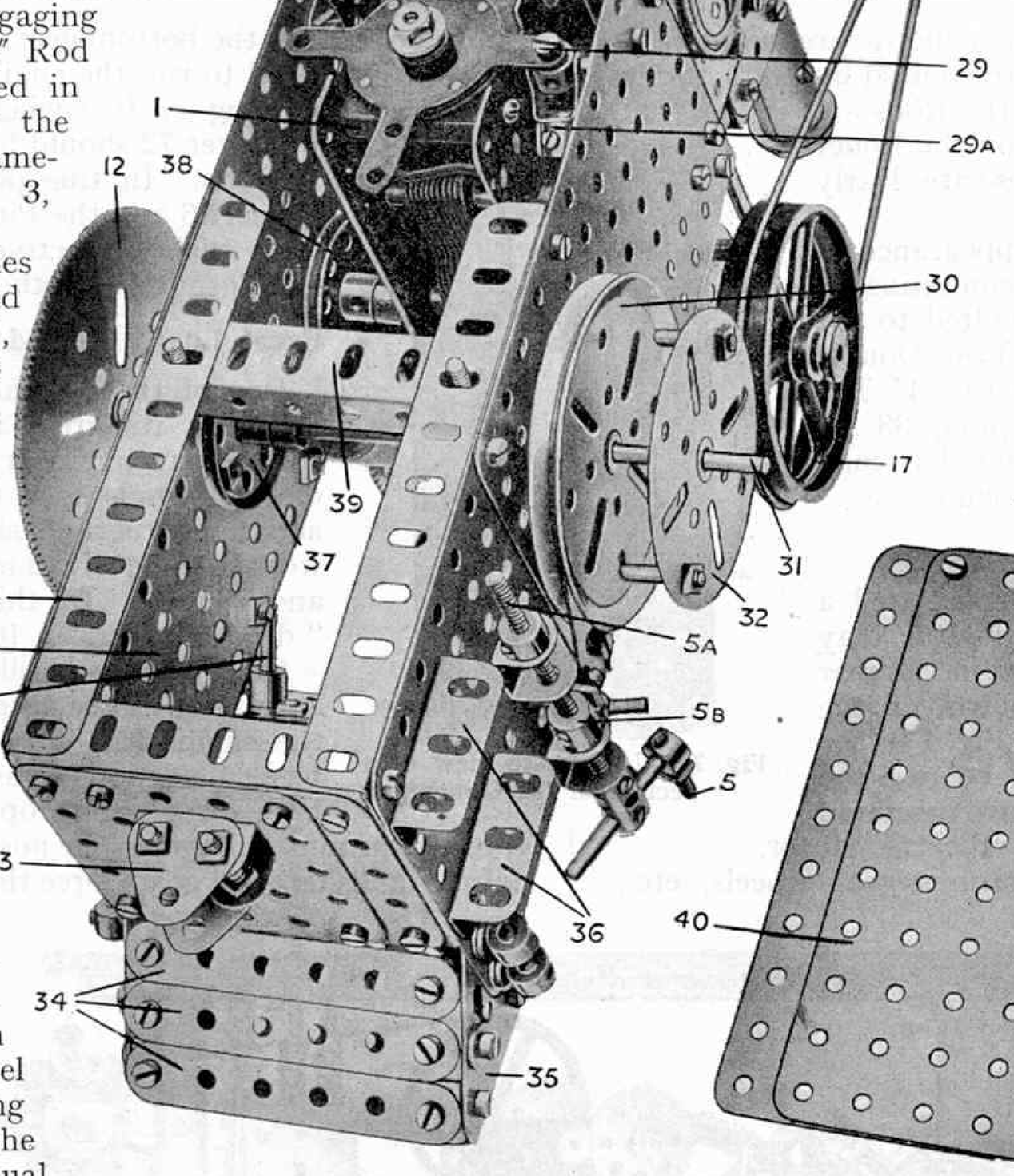


Fig. 5. Underneath view, showing Steering Gear and Electric Motor, etc.

Building the Driving Wheels

The actual construction of the driving wheels (see Figs. 3 and 4) should offer little difficulty. Two Hub Discs bolted together and secured to a Bush Wheel (which acts as a hub) form both the right and the left-hand wheel but slightly differing methods are adopted to secure them to the axles. In the case of the right-hand wheel (shown in Fig. 1, October "*M.M.*") the method is as follows :—

Two $\frac{3}{4}$″ Bolts are secured by nuts to the Hub Discs, the bolts being 1″ from the centres of the discs and placed diametrically opposite to each other. When the wheel is placed on the Axle Rod 31 (Fig. 5 ; also Fig. 3, October "*M.M.*") it will be found that the shanks of the bolts will engage in the holes or slots of the $3\frac{1}{2}$″ Gear Wheel 12. The idea of this arrangement is to provide a more secure hold for the road wheel than would be possible simply by tightening the set-screws of the Bush Wheels secured to the Hub Discs.

In the case of the left-hand driving wheel it is necessary to space it from the frame plate of the rear portion in order to allow sufficient clearance for the Flywheel 17 (Fig. 4), and for this purpose a $2\frac{1}{2}$″ Face Plate 32 (Fig. 5) carrying two Threaded Pins is passed over the Rod 31 and its set-screw tightened so that it is secured with the Threaded Pins engaging slots or holes in the brake drum 30. The left-hand driving wheel may now be placed in position, the $\frac{3}{4}$″ Bolts of the wheel engaging slots or holes in the Face Plate 32.

The Motor Control

The control handle for the 4-volt Electric Motor is shown at 71 (Fig. 4). By pulling or pushing this handle the Motor may be started, stopped, or reversed. The handle, which consists of a 1″ Rod inserted in a Handrail Support, is secured by a Coupling to a $4\frac{1}{2}$″ Rod on the lower end of which is a Swivel Bearing 29a (Fig. 5) attached pivotally by a bolt 29 to one of the Motor switch arms.

A support and guide for the $4\frac{1}{2}$″ Rod is formed by a Collar pivotally attached by a bolt to the side plate of the frame, the bolt being locked in position against the Collar by a nut (see Fig. 4). It is important to note that the bolt does not nip the $4\frac{1}{2}$″ Rod ; the latter must be quite free so that the Motor switch may be moved by pushing or pulling the handle 71.

Constructing the Canopy and its Supports

The canopy (Fig. 6) may now be constructed. It is built up from three $5\frac{1}{2}$″ × $3\frac{1}{2}$″ Flat Plates 41 joined

together with the centre Plate overlapping the rear end Plate by three holes and the front end Plate by four holes. The sides of the canopy are extended by $7\frac{1}{2}$" Strips 41a joined to the Plates 41 by Flat Brackets, and the portion that surrounds the chimney is formed by 2" Flat Girders 20c secured to the front Plate 41 and to a $3\frac{1}{2}$" Flat Girder, the latter being joined to the $7\frac{1}{2}$" Strips 41a by Flat Brackets.

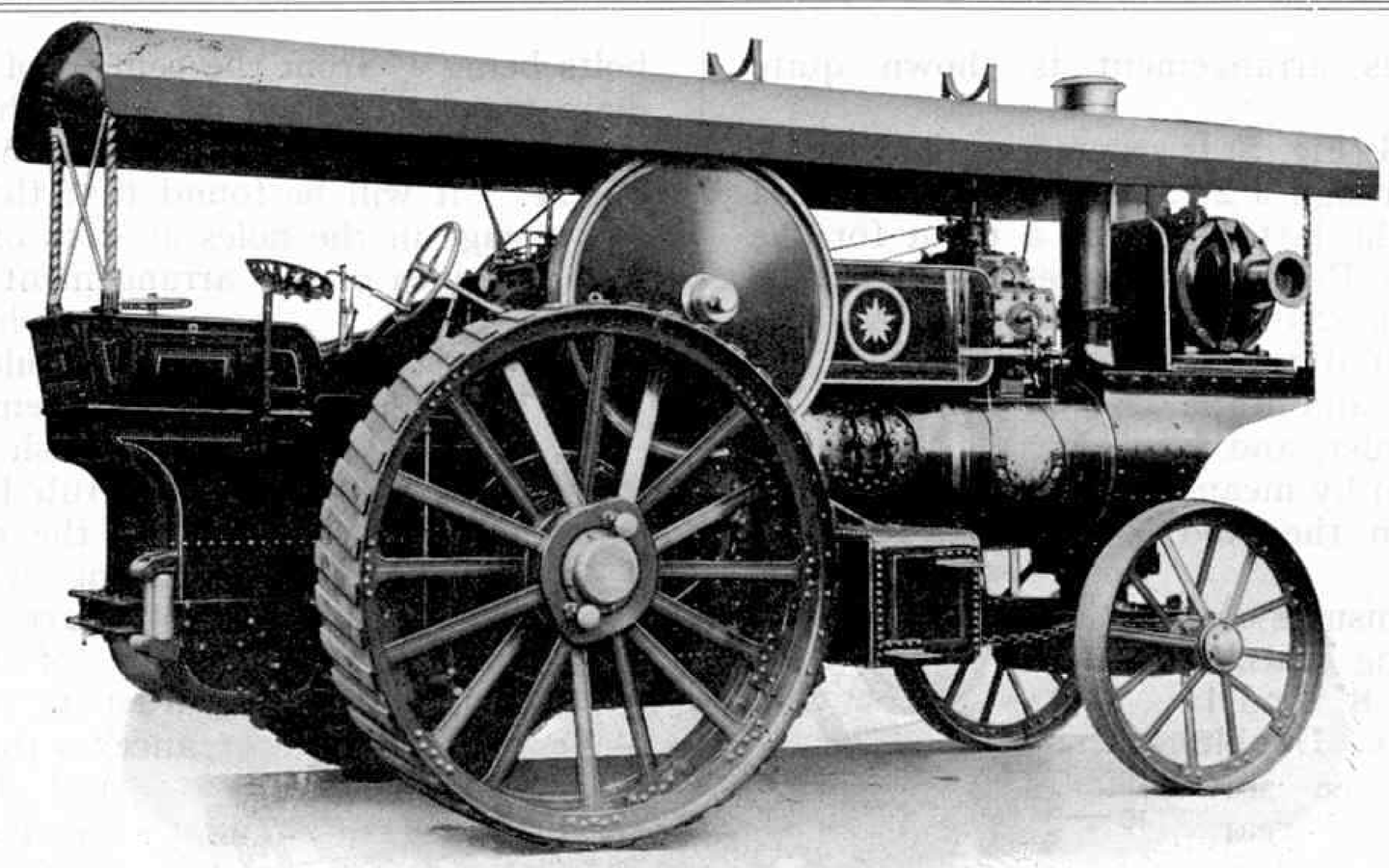


Fig. 8. This splendid engine is the prototype of the Meccano model. It was built by Ransomes, Sims & Jefferies Ltd. (Ipswich), to whom we are indebted for the photograph

The $3\frac{1}{2}$" Rods 20 forming the supports for the canopy are secured in Couplings 20a, which in turn are secured by bolts to the Plates 41. The lower ends of the Rods are secured in Collars 80a carried on the Boiler and bunker frame Plates. These are clearly shown in Fig. 4.

To complete the realistic appearance of the model steps 36 (Fig. 5) consisting of $1\frac{1}{2}$" Angle Girders should be bolted to the Plates of the main frame. Two Double Brackets to which are bolted two 1" Triangular Plates form the coupling 33 by means of which the trailer draw-bar may be attached to the traction engine.

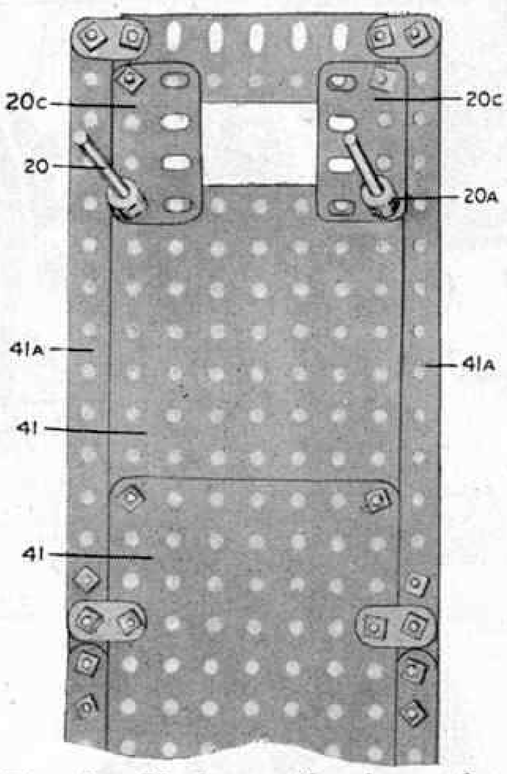


Fig. 7. Underneath view of a Section of the Canopy

General Remarks

When the model has been completed a Meccano 4-volt 8-amp. Accumulator may be placed in the space provided in the rear portion of the model as shown in the general view of the model (see Fig. 1 in the October *"M.M.,"* also Fig. 6 below), the terminals being connected by two insulated wires to the terminals of the Electric Motor.

In order to prevent the various gear wheels, etc., slipping on the shafts when the model is hauling heavy loads, it is wise to tighten two set-screws on each Gear Wheel (assuming, of course, that the wheels are fitted with the new-style bosses, the tapped holes of which pass completely through the bosses, diametrically). If this is done there will be no trouble with loose Wheels.

To set the model in operation it is necessary first to engage the slow or bottom gear by moving the lever 72 over to the extreme left. Before switching on the Electric Motor see that the brake is "off," i.e., with cord slack. Now switch on the Motor by pulling or pushing the handle 71 (Fig. 4) according to the direction (either forward or reverse) in which it is desired to travel. When only a light load is being hauled or the engine is running "light" the fast or top gear may be employed, but for the heavier loads the bottom gear should always be used. When it is desired to run the engine without the tractor moving (such as when driving the dynamo) the lever 72 should be placed in the central position. In this position both the Gear Wheel 56 and the Pinion 44 are disengaged from their respective gears and no power is transmitted to the driving wheels.

Great Loads Hauled by the Model

One of the outstanding features of this model is its great load-pulling capacity. The illustration incorporated in the heading of this article is a reproduction from an actual photograph showing the tractor at work hauling a load many times its own size and weight. In this particular case the "driver" weighs 100 lbs.!

Of course, in hauling a load of this description it will be necessary to add ballast to the engine for, unless firmly held down, it has a tendency for using its back axle as a base for pivoting operations! The engine affords a curious sight when the nose rises in the air as the flying crankshaft and gears force the driving pinion round the stationary axle! The additional weight required can be obtained by filling the Boiler with pieces of lead or a large number of Meccano Strips.

To obtain the best results care must be paid to every detail of the construction and the gear shafts must run quite freely. A little oil applied to the Gear Wheels and Rods will greatly assist the smooth working of the model.

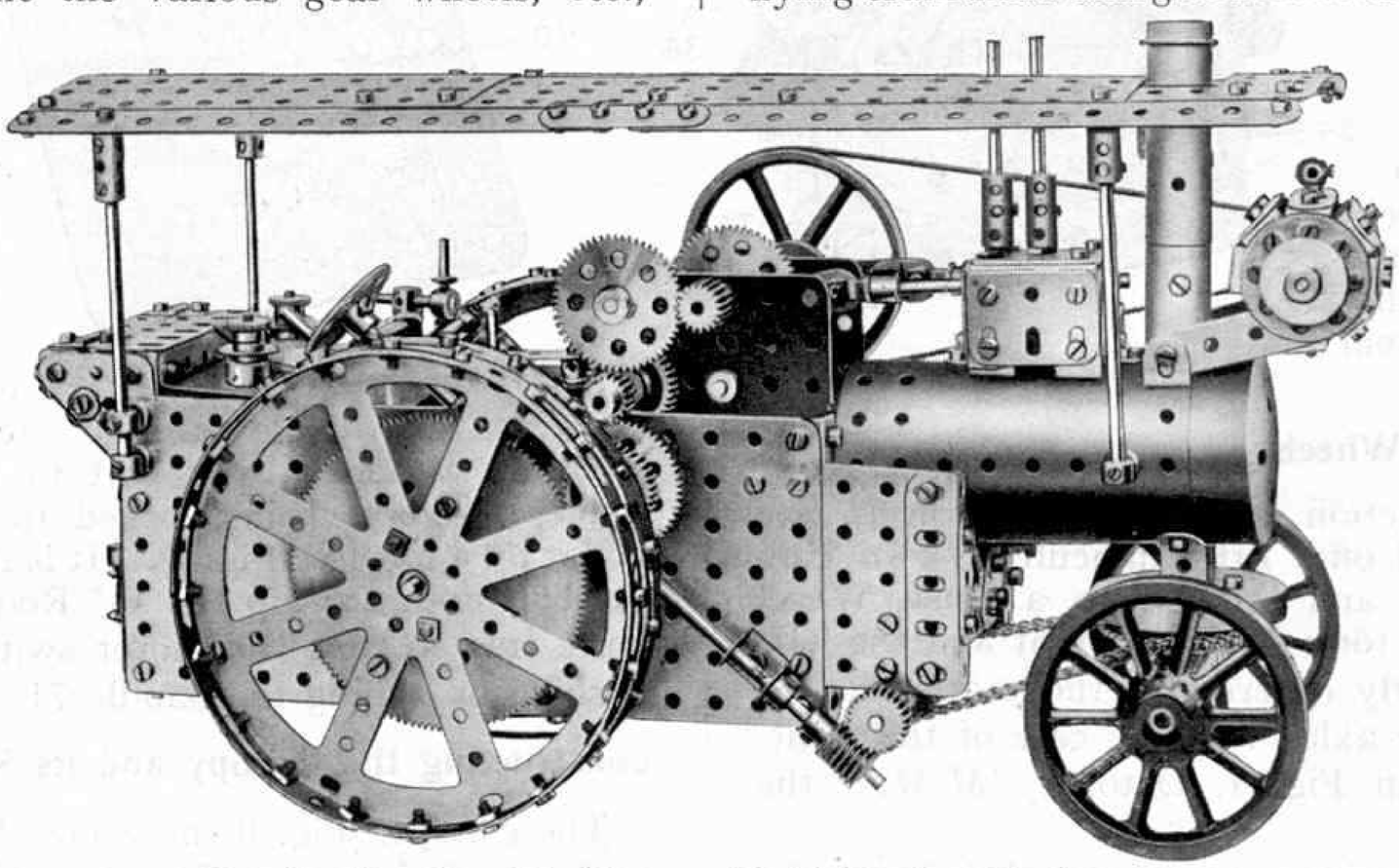


Fig. 6. The Complete Meccano Model Traction Engine

For list of parts required to build this model see October "M.M.," p. 851.

Scientific Apparatus in Meccano

Microscope Accessories made by Dr. Ernest Bade

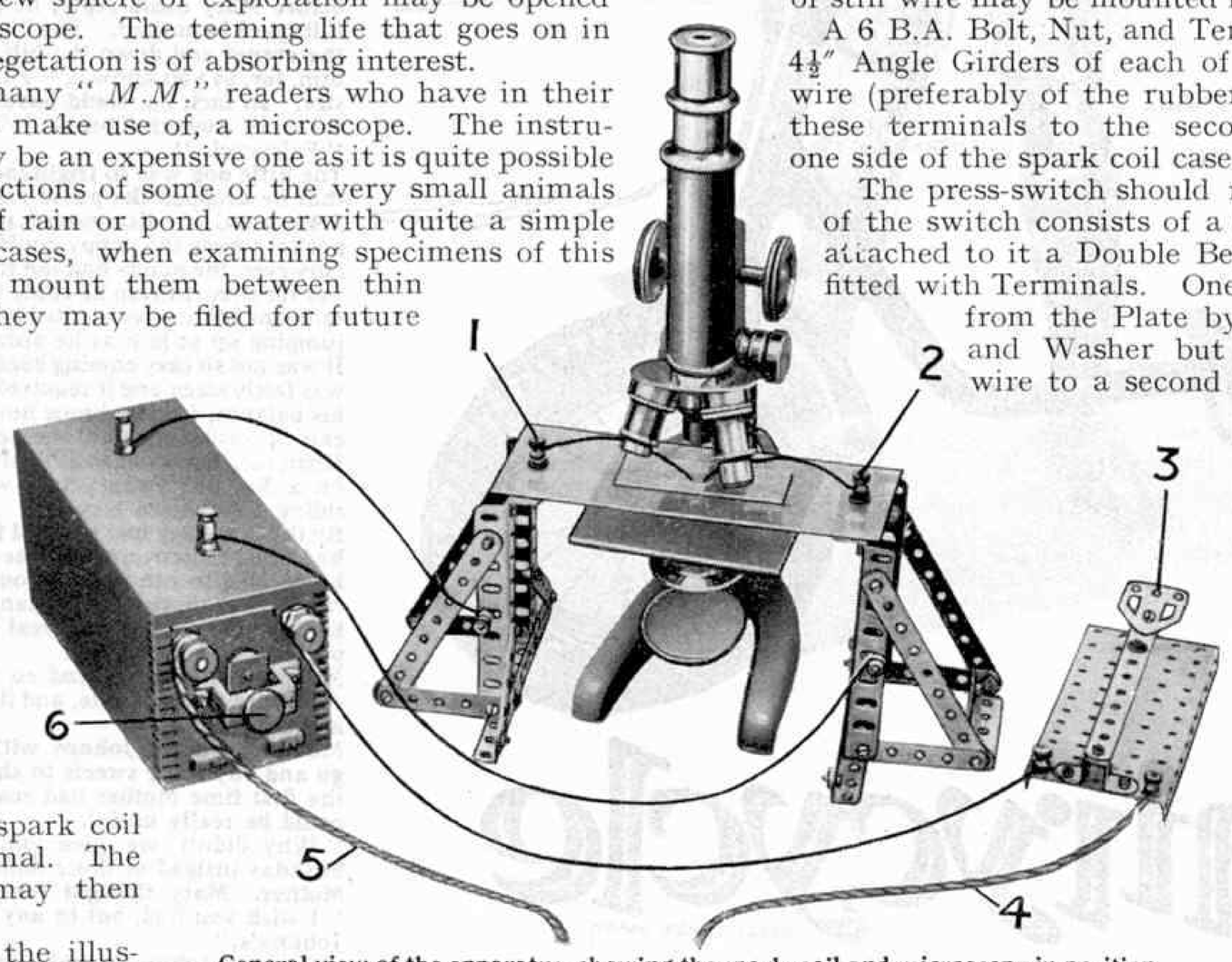
I.—AN ELECTROCUTING DEVICE FOR MICROSCOPIC ANIMALS

THE wonderful adaptability of the Meccano system is well-known to most "*M.M.*" readers, but it may come as a surprise to some people to learn that Meccano can be utilised in constructing delicate apparatus for use in connection with the study of microscopy. Meccano is used by Dr. Ernest Bade in the construction of all kinds of instruments and experimental apparatus that he uses in his scientific studies. We have received particulars of a number of these instruments, and details of one are given in full below. We propose to include descriptions of others in the Magazine from time to time.

Nature study is a subject that appeals to most of us, and without doubt it forms one of the most interesting and instructive spare-time occupations. While a great deal of pleasure may be obtained by studying the animals, birds or insects that are visible to the naked eye, an entirely new sphere of exploration may be opened up by means of a microscope. The teeming life that goes on in the air or in water and vegetation is of absorbing interest.

Doubtless, there are many "*M.M.*" readers who have in their possession, or are able to make use of, a microscope. The instrument need not necessarily be an expensive one as it is quite possible to study the form and actions of some of the very small animals present in, say, a drop of rain or pond water with quite a simple instrument. In many cases, when examining specimens of this kind, it is required to mount them between thin slips of glass, so that they may be filed for future reference. It is here that a difficulty occurs, for it is practically impossible to kill such tiny animals in the ordinary manner without totally destroying their original shape.

With the apparatus about to be described, however, it is possible to execute a minute animal instantaneously by pressing a switch, so causing a high-voltage current generated by a spark coil to pass through the animal. The electrocuted specimen may then be studied at leisure.



General view of the apparatus, showing the spark-coil and microscope in position

It will be seen from the illustration that, in addition to the microscope and Meccano parts, a spark-coil is required to complete the apparatus, and the rather high cost of one of these coils might at first deter readers from carrying out the experiments. There is no necessity to purchase a brand new coil, however, for a second-hand article, which can be bought at many electrical stores, will be found quite satisfactory. The coil shown in the illustration is of an old "army" type used in field transmitters during the war, and many dealers in government surplus materials are willing to sell these coils for quite a small sum.

Again, a spark coil, somewhat similar to that illustrated, was at one time fitted to the Ford car, and it should be quite a simple matter to obtain one of these from a garage or electrical shop, for a few shillings.

Commencing to Build the Instrument

The standards holding the glass plate should first be constructed. Each consists of two $4\frac{1}{2}''$ Angle Girders spaced apart at their upper ends by $2\frac{1}{2}''$ Angle Girders and at the bottom by $5\frac{1}{2}''$ Angle Girders. The upright Girders are further strengthened by $4\frac{1}{2}''$ and $2\frac{1}{2}''$ Strips bolted in the positions shown and spaced by a $2\frac{1}{2}''$ Angle Girder held to the Strips by means of Angle Brackets.

When these standards have been completed a strip of clear glass, approximately $6'' \times 2''$, should be obtained, and two holes bored in it to receive the Terminals shown. The drilling of the holes can be carried out with the aid of a three cornered drill, but those who do not wish to undertake this operation (which calls for considerable care if the glass is to be drilled properly, and not cracked) may avoid the necessity of passing bolts through the glass by using clips to hold the glass in place. The clips may consist of Flat Brackets bolted to the $2\frac{1}{2}''$ Angle Girders on which the glass plate rests, and the Terminals should be connected to them. Two clips should be used at each end of the plate.

The two standards should next be screwed down to a base of hardwood or some other insulating substance and the glass plate placed on top of the supports and fastened in position.

In the illustration each end of the plate is shown secured by means of a 6 B.A. Bolt pushed through the centre slot in the $2\frac{1}{2}''$ Angle Girder and also through the drilled hole in the plate. A 6 B.A. Nut and Terminal is screwed on each Bolt so that short lengths of stiff wire may be mounted in the positions indicated.

A 6 B.A. Bolt, Nut, and Terminal is attached to one of the $4\frac{1}{2}''$ Angle Girders of each of the standards, and lengths of wire (preferably of the rubber covered type) are taken from these terminals to the secondary terminals mounted on one side of the spark coil case.

The press-switch should next be constructed. The base of the switch consists of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate having attached to it a Double Bent Strip and two 6 B.A. Bolts fitted with Terminals. One of these Terminals is insulated from the Plate by means of an Insulating Bush and Washer but is connected by a length of wire to a second insulated 6 B.A. Bolt fastened to the centre of the Plate. The other Terminal is in electrical contact with the Plate. The switch arm consists of a $5\frac{1}{2}''$ Strip rigidly secured to the Double Bent Strip and fitted with a 6 B.A. Bolt and a Flat Trunnion 3. Upon depressing the latter the 6 B.A. Bolts are brought together and thus current can flow between the two Terminals of the switch.

A length of wire 4 should be taken from one Terminal of the switch to one pole of a 6- or 4-volt accumulator. The wire 5 is attached to the second terminal of the accumulator and its other end is fastened between the binding nuts of one of the primary terminals mounted on the spark coil box. Finally, a length of wire connects the other primary terminal and the second terminal of the switch.

All is now ready for carrying out the experiment. The two short wires should be arranged so that their ends are about $\frac{1}{8}''$ apart. Upon depressing the Flat Trunnion of the switch a spark should pass between the ends of the short wires. If a spark cannot be obtained the ends of the wires should be brought nearer together and the interrupter screw 6 on the end of the coil box should be adjusted. Having obtained the spark the drop of water, known to contain the minute animal that is to be examined, is next placed on the glass slip. The latter should then be placed on the glass plate so that the drop can be viewed through the eyepiece of the microscope in the usual manner, care being taken to see that the ends of the two wires dip into the fluid.

When the animal is seen to be in a suitable position between the ends of the wires the switch should be closed by depressing the Flat Trunnion and a charge of electricity will pass between the ends of the wires, thus electrocuting the animal. The dead animal may then be mounted between glass slips in the usual manner.

Other interesting experiments may be carried out by substituting specimens of plant and animal tissue in place of microscopic animals, and noting the varying effect that the electric discharge has upon them.

"Fairycycle" Association

All "Fairycycle" owners are eligible for membership witnout fee. Every "Fairycycle" has a badge attached. The membership forms, which are given with every "Fairycycle," should be filled up and sent to Lines Bros. Ltd.



The No. 8 Fairycycle
REGD TRADE MARK

HAS REAL

Dunlop Balloon Tyres

The price of the No. 8 Model is 87/6. The specification includes nickel-plated rims, upturned handle bars, rim brake, cycle stand and carrier.

OTHER FAIRYCYCLE MODELS

No. 1, with tangent spoke wheels, ⅞" ribbed tyres, stand and carrier 39/6

No. 2, with stand and carrier, ⅞" ribbed tyres, rim brake, upturned handlebars, tangent spoke wheels. 49/6

No. 3, De Luxe Model, with ball bearing wheels, 1" ribbed tyres, plated rims, etc. 59/6

No. 4, Super Fairycycle with ball bearings throughout and spring saddle, 1" cushion tyres 65/-

No. 6, Senior Model with 16" wheels, 1" ribbed tyres, ball bearings throughout 70/-

No. 7, as Model 6, but with 16" × 1⅜" pneumatic tyres 75/-

Fairycycles are obtainable from all high-class Toy Dealers everywhere. If you are interested in model Motor Cars, Cranes, etc., ask for free folder illustrated in colours.

Fun on a Fairycycle

CHAPTER THREE

You remember the great fun Johnny got with his "Fairycycle" when his Mother asked him to take that note to Mrs. Smith. Well, we are going to tell you this month how Mary got into difficulties and was saved from trouble by Johnny with the aid of his "Fairycycle." It happened like this. Johnny's Mother told Mary to fetch some cooking apples from the shop in the village. Mary put on her hat, picked up the shopping basket, and placed the money which Mother had given her in a neat little purse.

Mother had been very careful to impress upon Mary that she must carry the money carefully in her hand, and see that she was given the right change.

Mary promised to do all this, and off she went.

On opening the gate she was startled by a small puppy which came jumping up at her—so startled, in fact, that she dropped the shopping basket and the purse.

Now that playful little puppy thought this was great fun, and immediately grabbed the purse in his mouth and made off as quickly as he could down the street.

Mary began to run after him, but was no match for the dog. Johnny, seeing his sister's distress, came to her assistance. "I will go after him on my 'Fairycycle'" he said, and before Mary could reply, he pedalled down the street at full speed in pursuit. The little dog ran on and on, round the corner and down the hill, but Johnny soon overtook him, for, as you know, a "Fairycycle" is very fast for its size. In fact, he would have run over the puppy but for the very powerful brake, which is fitted to the No. 8 "Fairycycle."

The little dog was so frightened at nearly being run over, that he dropped the purse and ran into a garden.

Johnny quickly dismounted, picked it up, and put it in his pocket where the puppy could not get at it.

However, the puppy had not finished yet, for he was really out for some fun, so he came tearing down the garden the moment Johnny remounted his "Fairycycle," and started jumping up at him as he pedalled up the hill.

It was not so easy coming back as it was going, for the hill was fairly steep and it required all Johnny's ability to keep his balance, for you know how you wobble when you put extra pressure first on one pedal and then on the other. However, it was not so difficult climbing this hill, for being on a No. 8 "Fairycycle" with ball bearings was like riding a full-sized bicycle.

By the time they had reached the top of the hill, the puppy had at last discovered that he could not upset Johnny, so he decided to run off and romp with another dog.

No one was more pleased than Johnny, and he turned into his garden gate feeling a real hero for having rescued the purse.

Mary was delighted, and so was Mother, for the purse contained a pound note, and it would have been a very big amount to lose.

Mother rewarded Johnny with sixpence and told him to go and buy some sweets to share with his sister. It was the first time Mother had realised that a "Fairycycle" could be really useful.

"Why didn't we give you a 'Fairycycle' for your birthday instead of those dolls and other things?" said Mother. Mary thought for a moment, and then said "I wish you had, but in any case, I don't mind sharing Johnny's."

"Come on Johnny," said Mary, "I know a game we can play with my dolls and your 'Fairycycle.'" Next month we will tell you what her idea was, but you will never guess.

L. BROS. LTD. LONDON BROS. ENGLAND

Regd. Trade Mark.
The Red Triangle Trade Mark on the "head" makes a genuine FAIRYCYCLE *easily distinguishable.*

Fairycycles are made by
LINES BROS. LTD.
114, Morden Rd., Merton, S.W.19

Competition Page

Famous Trains Voting Contest

Mr. Cecil J. Allen's articles on "Famous Expresses" which have appeared month by month since January of last year have proved one of the most popular features the "*M.M.*" has ever introduced. Large numbers of readers have written to express their enthusiasm for these articles and to say how greatly the interest of a long journey by a famous express has been increased as the result of reading Mr. Allen's article on that train, and especially so if they had the article with them at the time.

Quite naturally the eagerness with which readers have looked for accounts of the runs of the famous expresses of their favourite line has caused mild protests when some other line has had the honour of providing the "express of the month." Everything comes to those who wait, however, and gradually Mr. Allen will satisfy everybody. In the meantime we should like to know which have been the most popular of these articles, and we therefore announce a voting competition with that object.

In the panel in the centre of this page there appears a list of the "*Famous Trains*" that have been described by Mr. Allen, and every entrant for the competition is required to state on a post-card:—

(1) Which of the trains is his favourite.

(2) What he considers will be the twelve most popular trains in the order of their popularity. It should be noted that competitors need not necessarily include in this forecast the trains that happen to be their own personal favourites.

(3) The name of a train that has not been dealt with so far and which would be suitable for inclusion in this series.

Aberdonian, L.N.E.R.	Manchester "Club" Trains, L.M.S.
Atlantic Coast Express, S.R.	Midland Scotsman, L.M.S.
Birkenhead Diner, G.W.R.	Queen of Scots, L.N.E.R.
Cornish Riviera, G.W.R.	Royal Scot, L.M.S.
Dover Pullman, S.R.	St. Gotthard Pullman, Switzerland.
Fishguard Boat, G.W.R.	Southern Belle, S.R.
Flying Scotsman, L.N.E.R.	Torbay Limited, G.W.R.
Folkestone Flyer, S.R.	Trans-Canada Limited, C.P.R.
Golden Arrow, France.	Union Express, S.A.R.
Hook of Holland, L.N.E.R.	West Coast Postal, L.M.S.
Irish Mail, L.M.S.	3.20 Down Manchester, L.N.E.R.

Prizes of Meccano or Hornby Train goods (to be selected by the winners) to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four competitors who give the most accurate forecasts of the final order of voting. In addition, there will be a number of consolation prizes.

Entries should be addressed to "Trains Forecast, Meccano Magazine, Binns Road, Liverpool," and must reach this office not later than 30th November. Overseas closing date, 28th February.

November Painting Contest

Next to the publication of the November "*M.M.*" the greatest thrill of the month for all Meccano boys will be "the Fifth." Obviously then any painting competition announced for this month must be connected with fireworks, and the subject we have chosen is a "Guy Fawkes' night bonfire." Competitors may use crayons if they prefer.

It is not necessary to explain the subject further, and we hope every reader whose fingers remain sufficiently free from burns to enable him to hold a paint brush or crayons will enter.

Prizes of Painting Materials or Meccano Products (to be chosen by the winners) to the value of 10/6 and 5/–, will be awarded to the competitors who submit the best entry in each of the usual two sections; A for readers aged 16 and over, and B for those under 16. Each competitor must give his name, address and age, on the back of his entry, which must be addressed to "November Painting Contest, Meccano Magazine, Binns Road, Liverpool," and sent to reach this office not later than 30th November. Overseas closing date, 28th February.

Initial Sentences

The Doublets and other word juggling competitions have proved so popular in the past that we feel sure readers will like this little test. It consists in providing two sentences, the initial letters of the successive words in which must begin with the successive letters forming the names "*Meccano*" and "*Hornby*." To make the point clear an example based on the name "*Meccano*" is given here:—"Meccano Entrances Creating Continually A New Outlook."

Prizes of Meccano Products or Hornby Train Goods (to be chosen by the winners) to the value of 10/6 and 5/– will be awarded to the two competitors who submit the best lines in each of the usual two sections, A for readers aged 16 and over, B for those under 16. Each competitor must give his name, address and age on the back of his entry, which must be addressed to "Word Building Contest, Meccano Magazine, Binns Road, Liverpool," and sent to reach this office not later than 30th November. Overseas closing date, 28th February.

COMPETITION RESULTS

HOME

Doublets No. 4.—Probably the Doublets set in this contest were somewhat more difficult than those of our earlier competitions—in certain cases they were designed to be teasers—but that fact proved of no importance to the big number of readers who sailed home with totals below 70 links.

The actual winning entry contained 59 links only but several entries totalling a lesser figure but containing inadmissible words such as well-known foreign words—the German *Herr* is a case in point—had to be disqualified.

As the Overseas section remains open we cannot publish the solution to the contest at this stage. The successful competitors in the Home section are:—1. F. Campbell (Castledermot, I.F.S.); 2. W. G. Shaw (Liverpool); 3. G. K. Jackson (Castledermot, I.F.S.); 4. G. Kenning (Birmingham). Consolation Prizes: A. G. Atkinson (Leeds); A. S. Gladwin (Carmunnock); K. W. Helmore (Forest Gate, E.7); A. Turner (Grays, Essex); R. Warren (Wolverhampton).

37th Photo Contest.—As we expected, there was a splendid entry for this competition, for the subject provided an opportunity for practically every reader to take part.

There were snapshots taken on the seashore—it is safe to say that there is not a "50-mile stretch" of English coast-line unrepresented in the views—in the mountains and valleys of Switzerland, Scotland and Wales, farm scenes from various parts of the Kingdom, while Killarney, Loch Lomond and Windermere represented Britain's lakes.

Awards were made as follows:—First Prizes: Section A, J. G. Makin (Romford); Section B, L. Sansom (Barrow-in-Furness). Second Prizes: Section A, H. G. Lancaster (Woking); Section B, A. E. Wood (Rotherham). Consolation Prizes: Section A, Miss M. Davison (Chiswick, W.4); J. W. Hollybank (Coventry). Section B, H. Jupp (Leytonstone, E.11).

Holiday Story Competition.—The announcement inviting readers to tell the Editor of the most interesting experience of their holidays, specially stated that "lack of thrills" would prove no disability. It was apparent from the number of really interesting but unvarnished stories sent in for competition that readers generally appreciated the assurance.

In the space available here it is out of the question to attempt a commentary on even the winning entries. We append the list of prizewinners:—First Prizes: Section A, W. Harbord (Normandy, Surrey); Section B, W. L. Simpson (Margate). Second Prizes: Section A, W. G. Stokes (Atherstone); B. C. B. Lovell (Bristol). Consolation Prizes: Section B, A. R. Barrie (Edinburgh); G. S. Parker (Southampton); B. A. Rose (Walthamstow, E.17).

OVERSEAS

Advertisement Fragments.—Overseas readers obviously are possessed of eyes every bit as keen as those of their fellow readers at home. There was a bumper entry for this competition and many completely accurate solutions were submitted. Following our usual practice the prizes were awarded to the competitors who sent in the neatest or most novelly prepared entries; due allowance being made for age wherever possible. The successful competitors were:—1. Macleod Morgan (Sydney, N.S.W.); 2. D. Black (Hamilton, N.S.W.); 3. R. Wallace (Durban, Natal, S.A.); 4. J. H. Scott (Gisborne, N.Z.). Consolation Prizes: L. Ison (Victoria, Australia); H. T. Jeffery (Durban, Natal, S.A.); L. G. Mauger (Cranbrook, West Australia); D. Ross (Cape Town).

OBJECTS of the GUILD

To make every boy's life brighter and happier.

To foster clean-mindedness, truthfulness, ambition and initiative in boys.

To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

The Meccano Guild

With the Secretary

Inter-club Visits

I am glad to notice that the practice of exchanging visits has been followed by several clubs during the past Summer. The clubs concerned came together to contest a cricket match or for a joint excursion to some place of interest. They invariably spent a jolly time, and the friendly visits will certainly be repeated.

It seems to me that something of this kind should also be tried during the Winter sessions. An invitation to pay a visit on the occasion of an exhibition or a concert, for instance, would be greatly appreciated by the members of neighbouring clubs, and would no doubt bring a similar courtesy in return. Clubs may also be brought together for football matches, while table-tennis is an indoor game that is very suitable for friendly team contests. In addition members of clubs who include debates in their programmes will find that a debate with another club widens their outlook and improves their oratory.

Correspondents Wanted

During the past twelve months the Correspondence Club has shown wonderful progress and applications for membership arrive regularly in large numbers. Members overseas are taking a particularly keen interest. Until recently my chief difficulty was to find suitable correspondents for the many English boys who wished to be put into touch with friends in other countries; now the position is completely reversed and boys overseas are waiting! I should like many more boys in England to join the club, and I can promise them interesting correspondents almost immediately. Those who join will not regret having taken the opportunity of learning something of the interesting lives of Meccano boys whose homes are in other countries.

The most remarkable increase in membership has been shown in France, and there is now a considerable waiting list of boys in that country. Most of them desire to correspond with English boys, but some wish to communicate with members in Italy and Germany. I shall be glad to enrol members in both countries.

A great increase in the demand for correspondents living in Canada and the United States is also noticeable. These countries are attracting the attention of members in France and Egypt, as well as in England, and any Canadian or American boy who wishes to exchange notes and views on subjects of common interest with one or more of them can very easily be accommodated. In addition, enthusiastic Guild members in Malta, India, Egypt, South Africa and the Straits Settlements are still awaiting friends, particularly in England. Boys of 14 to 18 who are interested in stamps or photography are specially wanted. Enjoyment of these hobbies is greatly increased by correspondence with an overseas chum of similar tastes.

Meccano Club Leaders

No. 37. Mr. F. Burford



Mr. Burford is the enthusiastic Leader of the Dudley Meccano Club. Although this club was affiliated only as recently as June last, it has already made very great progress. Mr. Burford organises the club meetings on rather novel lines. They are held from 3 p.m. to 8 p.m. on Saturdays, and tea at 5 p.m. gives a jolly social air to each meeting. The club's chief activities are Model-building, Lectures and Games.

Avoiding Delay

New members of the club are sometimes disappointed by a little delay occurring in finding suitable correspondents for them. This is very often due to their asking for friends in parts of the world where the population is small and the number of Meccano boys limited. It is not easy to find correspondents in Tibet or Alaska, for instance! Some members also insist that their correspondents shall be interested in an uncommon hobby, and this also may be the cause of delay.

The situation would be made very much easier for the Headquarters staff if each member were to name alternative countries on his enrolment form, and at the same time to give additional hobbies or subjects in which he is interested. When this is done there is usually very little difficulty in providing a member with a suitable correspondent within a reasonable time. His chief requirements are not forgotten, however, and at the first opportunity he is placed in communication with a boy in the country first chosen by him. This, of course, does not mean that the first correspondence shall come to an end, as each member is allowed three correspondents.

A Reminder to Unaffiliated Clubs

Once more I find it necessary to draw the attention of secretaries of clubs not yet affiliated to the importance of sending regular reports for inclusion in "Club Notes." I do not receive as many of these as I could wish, probably because secretaries imagine that such details as they can supply are not sufficiently interesting. This is quite a mistake. Nothing gives me greater pleasure than to record the growth of a club from small beginnings to an established position among affiliated clubs. I am often able to give advice regarding the working of a club that will speed up its progress, but I cannot do this unless I am fully informed of its activities. This can best be done by means of regular reports, and I hope to receive more of these every month from the secretaries of clubs that have not yet been affiliated.

Proposed Clubs

Attempts are being made to form clubs in the following places and boys interested should communicate with the promoters, whose names and addresses are given below:—

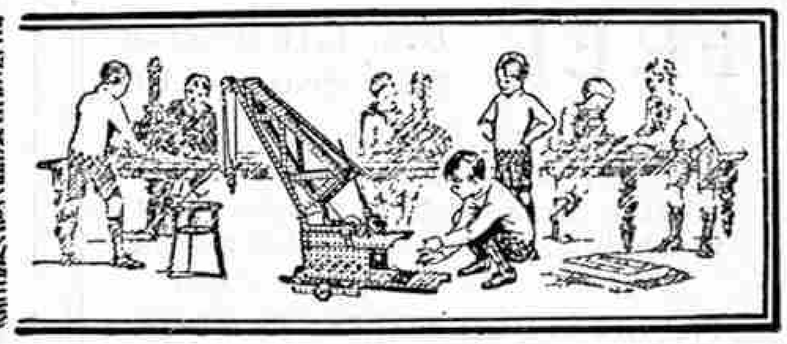
BIRKENHEAD.—Wm. R. Lowthian, 91, Elmswood Road, Higher Tranmere, Birkenhead.

BURTON.—Frank Kerry, 39, Wood Street, Burton.

WEMBLEY.—G. B. Weightman, St. Malo, 1b, Vivian Avenue East, Wembley.



CLUB NOTES



Belgravia (Bromley Hill) M.C.—The new session commenced very well with a Model-building Competition and an Exhibition at a local Garden Fête, when a sum of more than 10/– was collected. Meetings are held on the second and fourth Tuesdays in the month in St. John's Church Institute, Catford. Joint meetings are to be arranged with the Woolwich and Plumstead M.C. A Table Tennis team is being formed and it is hoped to play matches against neighbouring Meccano clubs. Club roll: 70. *Secretary:* R. Woolidge, 29, Coniston Road, Bromley Hill, Kent.

Bristol Grammar School M.C.—A very successful winter session is expected. An Indoor Games Section has been formed, and arrangements made to visit the Peckett Locomotive Works and a local Paper Mill. Model-building Evenings and Hornby Train Nights are greatly enjoyed. The Leader is to give a lantern lecture on "*The Lake District.*" Club roll: 35. *Secretary:* J. C. M. Salter, 88, Hampton Road, Bristol.

Dudley M.C.—The excellent programme drawn up includes Model-building, Games Evenings and Lectures on "*Portsmouth Docks*" and other engineering subjects. An Exhibition and Social will bring the session to a close. Members are selling scent cards to raise funds to buy a Meccano Outfit for the club. More members are required and the secretary will be glad to hear from any boy wishing to join. Club roll: 15. *Secretary:* W. E. Darby, 93, Queen's Cross, Dudley.

Holy Trinity (Barnsbury) M.C.—The opening of the new session found all members enthusiastic. Meetings are now held on Fridays at 7-30 p.m. and the earliest were devoted to making Meccano and other models for the Tenth Annual Exhibition. Several of the members recently paid a very enjoyable visit to the Becton Gas Works. The club has purchased a quantity of hand-made railway track from the now disbanded St. Mary (Newington) M.C. Club roll: 50. *Secretary:* Mr. F. W. Johnson, 23, Market Street, Edgeware Road, Paddington, W.2.

Norbury M.C.—Model-building and Games Evenings continue to be the chief attractions. At one of these the secretary demonstrated the working of the Meccano Loom on a model constructed by himself. Visits have been paid to a Milk Factory and the Croydon Gas Works. In each case guides conducted the members round and explained everything fully. A splendid lecture on "*Africa*" was given by the Vicar, who spent 35 years as a missionary. Club roll: 20. *Secretary:* A. F. Young, 21, Stamford Road, Norbury, S.W.16.

Parkstone M.C.—Prospects for the winter sessions are very bright. Hornby Train Nights are a great attraction and are frequently arranged. An interesting evening was spent in inspection of a splendid scale model of a liner brought by a member. A plan for circulating the "*Meccano Magazine*" has been put into operation. Each member retains a copy for a week. Club roll: 14. *Secretary:* Eric Bath, 165, Ashley Road, Parkstone.

Stansted M.C.—The Exhibition proved a great success. The models displayed were of a very high standard, and the first prize was won by a cleverly-built model of a "Coaster." The prizes were so good that they absorbed all the receipts except one penny! Club roll: 11. *Secretary:* G. Haselden, Bank Cottages, Stansted, Nr. Sevenoaks, Kent.

Woolwich & Plumstead M.C.—A party of members visited London in order to see the B.B.C. studio at Savoy Hill and the Science Museum at South Kensington. Other visits were paid to the Cunard liner "*Caronia*" and to battleships at Chatham. Several members were allowed to train the guns of H.M.S. "*Vindictive*" on other ships in the dock. The winter programme includes Football and Indoor Games. Club roll: 63. *Secretary:* S. E. Weller, 22, Woodhurst Road, Plumstead, London, S.E.18.

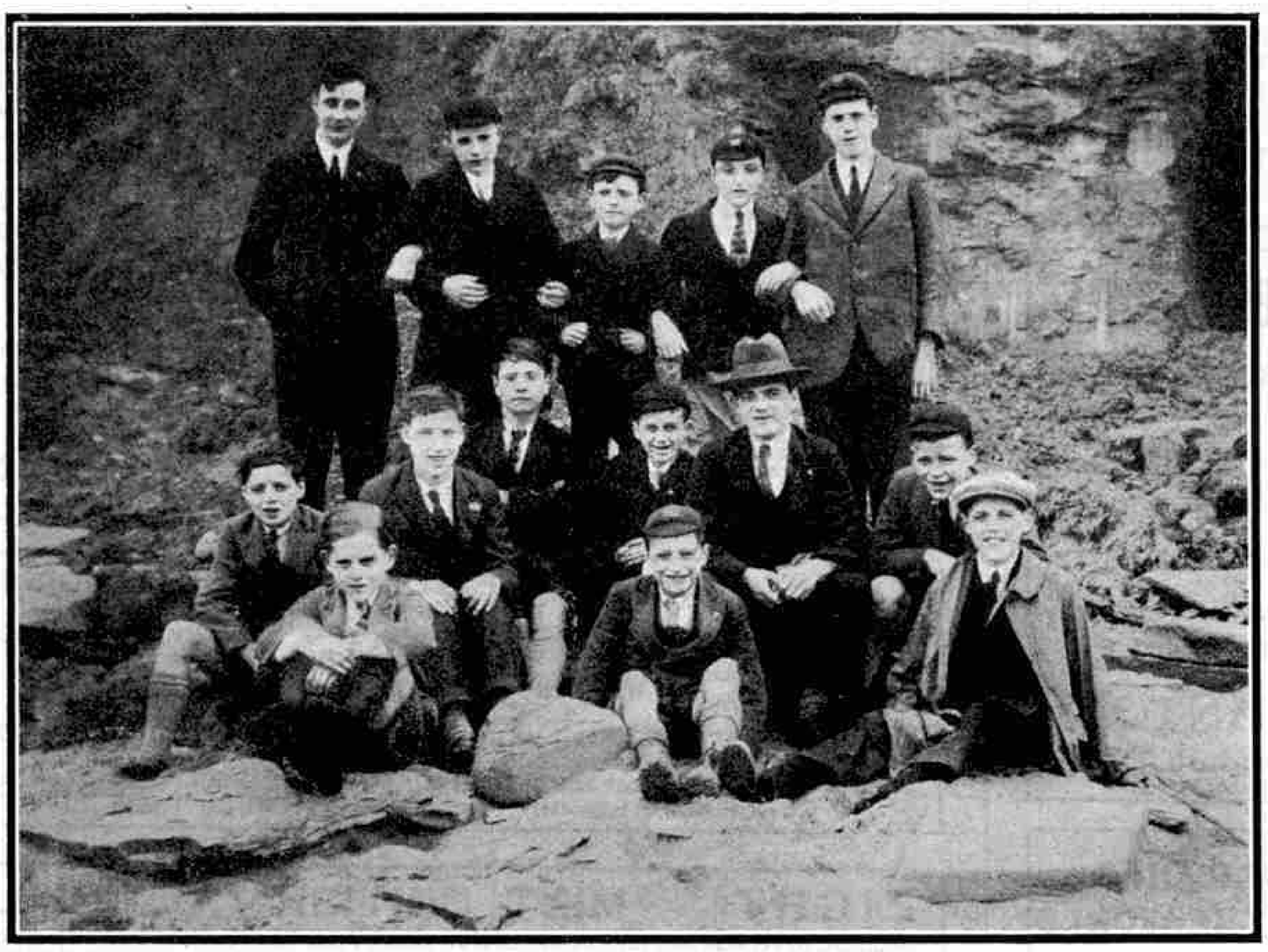
Castle Douglas M.C.—Is preparing a display of models for a window kindly lent by a local shopkeeper. All members have been busy building and improving models and a Meccanograph from Headquarters is also to be on view. A new game now played is hand ball with balloons. Members are divided into sides and goals are scored by blowing or pushing the balloon to touch the walls at the end of the room. The goalkeepers are allowed to stand on a chair. Club roll: 24. Leader: P. Thomson, 106, Queen Street, Castle Douglas.

Harehills (Leeds) M.C.—Has now secured affiliation. A room in a central situation has been secured and the club is divided into three sections—Nuts, Bolts and Washers. An Exhibition is to be held at Christmas and it is hoped to publish a Magazine regularly. Club roll: 20. *Secretary:* Robert K. Fourness, 12, Berkeley Street, Harehills.

Atherstone Grammar School M.C.—Every member has entered a Model-building Competition promoted by the local Meccano dealer. The programme includes Model-building, Lantern Lectures and an Exhibition. A contest for the Air Gun Shooting Championship of the club is also to be arranged. Club roll: 21. *Secretary:* W. C. Stokes, 11, Stafford Street, Atherstone, Warwickshire.

Harwich M.C.—The proceeds of the last Exhibition were used to provide a day's outing, which took the form of a motor-bus tour of the Essex coast. The Chairman, the Rev. L. H. Hinder, is leaving to take up duty at Croydon. His departure will be greatly regretted by the members and it is proposed to make him a presentation. During the winter three meetings per month will be devoted to hobbies and the fourth will be a social evening. A new Assistant Leader, Mr. H. Miller, has been appointed, and he will organise a wood-working section. *Secretary:* Mr. A. E. Ward, Osborne House, Pepys Street, Harwich.

Middlesbrough M.C.



Our photograph shows a group of members of the Middlesbrough Meccano Club taken on the occasion of their second annual outing to Runswick Bay. The energetic secretary, A. Bradley, is the second figure from the left in the middle row and the fifth in the same row is the treasurer, Mr. T. M. Sizer, who is at present acting as temporary Leader. The excursion was greatly enjoyed, and members felt very important when a special locomotive came along to shunt their saloon at a junction!

Clubs not yet Affiliated

Darwen M.C.—Hornby Train Night is always popular. Members bring their trains and rails and a large track is laid down. A Mystery Hunt caused great excitement and was so great a success that it will be repeated. *Secretary:* J. Eatough, 16, Bridge Street, Darwen.

Cowlersley M.C.—A well-attended Exhibition has been held, the models on view including Cranes of various types, a Cantilever Bridge, a Motor Van and an Aeroplane. The secretary explained the models to visitors, who were greatly interested. An excellent winter programme has been arranged. Club roll: 23. *Secretary:* H. Wilson, 40, Western Road, Cowlersley, Huddersfield.

Exhall M.C.—The membership shows a splendid increase but there is still room for more recruits. An Exhibition will be held at Christmas and a Concert is also to be organised. It is anticipated that the club will soon be affiliated. *Secretary:* M. Melville, Exhall Vicarage, Coventry.

Morecambe M.C.—Meetings are being held regularly, but a club-room has not yet been secured and difficulty is also being experienced in securing a Leader. The secretary would be very glad to hear from any gentleman in the district who would be willing to help. Club roll: 10. Tom Banks, "Swanmore," 47, West End Road, Morecambe.

Worthing M.C.—Model-building, Drawing and Painting Competitions are held weekly and a prize is awarded to the member with the highest total of marks. A Lecture on "*The History of Railways*" is being given in serial form. On Hornby Train Nights three engines and 20 trucks and coaches are in use, and complicated operations are successfully carried through on a large layout. Club roll: 12. *Secretary:* Raymond Knowles, "Shanklin," 69, St. Thomas Road, Worthing, Sussex.

Overseas Affiliated Clubs

Dunedin M.C.—Recent meetings have included a Five-minute Lecture Night, and a Demonstration of a Model Motor Chassis built by the secretary. Several Model-building Contests are to be held and a visit to the Dunedin Observatory has been arranged. Club roll: 14. *Secretary:* Tony MacLachlan, Art Studio, 66, Albany Street, Dunedin, Otago, New Zealand.

Wanganui M.C.—Visitors' Night attracted many friends of the members, including the Superintendent of the Fire Brigade, who judged the Models. Model-building Competitions are held monthly. Club roll: 20 *Secretary:* S. Smith, 16, Selwyn Street, Wanganui, New Zealand.

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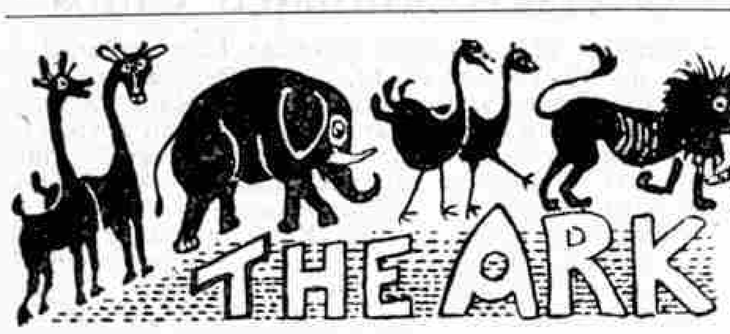
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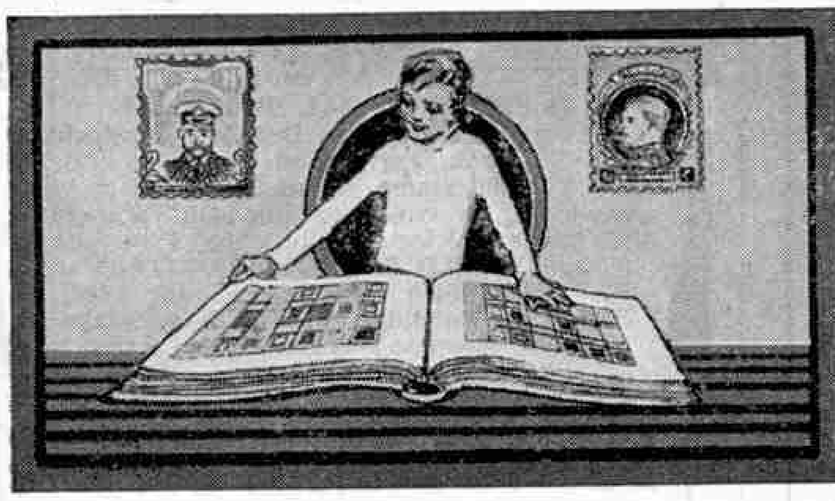
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Stamp Collecting

HOW TO COMMENCE THE HOBBY (II.)

IN the first part of this article published last month we set out to give practical advice and guidance to those of our readers who are taking up stamp collecting for the first time. We dealt with the importance of good equipment—the album, the mounts and the catalogue — and we emphasised the desirability of deciding first of all that only certain varieties of stamps were to be included in the collection.



Esthonia 5p., 1919 issue

We may assume now that our stamp collecting novice has secured his equipment and is ready to commence mounting his stamps in his album. From this moment he will begin to realise rapidly the value of our advice to purchase a catalogue. Without a catalogue the mounting of the stamps in the album is little more than a matter of guesswork. The catalogue may be consulted concerning every individual stamp and it gives precise information that enables the collector to place his stamps in their right positions without hesitation.



Holland 15c., 1924
Charity issue

In preparing his stamps for mounting, the collector should first sort them out into their respective countries and then, having ascertained the correct order of issue, decide upon the exact position that each stamp is to occupy in the album. In mounting a stamp in position it should be remembered that at some future time it may be desired to examine the watermark, and for that purpose the back of the stamp must be readily accessible without necessitating the removal of the stamp from the page. This can be managed by fixing the mount close to the top of a rectangular stamp or to the left hand side of a triangular stamp. If preferred, rectangular stamps may be "side mounted" so that the watermark may be inspected right side up without inverting the album. In this case the mount should be folded lengthways and fixed to the right-hand side of the stamp.



Lithuania 1m., 1921



Switzerland 30c., Postal Union Commemorative, 1924

To fix the mount, about a quarter of an inch should be turned down, gum side out, and the "turn down" fastened to the stamp. The stamp must be placed in the centre of the space allotted to it and care should be taken to see that no part of the mount is visible when the stamp is in position. Occasionally a mistake may be made in the stamp's position. The removal of the stamp while the mount is still moist must not be attempted, however, otherwise it will probably bring away some of the surface of the album at the same time. The stamp should be left for an hour or so until the mount is dry, when it will peel away easily.



Greece 3 dr., 1927

Up to this stage we have assumed that the stamps being handled were all ready to be mounted but many stamps will be received still attached to the envelope on which they have done their work. Only when the retention of the complete envelope is necessary to show the purpose for which the stamp was used—such as for Air Mail—or when the stamp is very old and its value is enhanced by the presence of its envelope, should paper be allowed on the stamp mounted in the album. Odd scraps of paper must not on any account be permitted to remain.



Irish Free State 3d., 1922

The removal of unwanted paper is a task that requires a good deal of patience and care. The paper may be got rid of in two ways—by peeling or floating off. In peeling it is of the utmost

(*Continued on page* 947)

Bayern.—Bavaria.
Ceskoslovenska Posta.—Czecho-Slovakia.
Cote d'Ivoire.—Ivory Coast.
Deutsche-Reichspost.—Germany.
Eesti Post.—Esthonia.
Emp. Ottomane.—Turkey.
Guine.—Guinea (Portuguese).
Guinee.—Guinea (French).
Helvetia.—Switzerland.
Island.—Iceland.
Latwija (or Latvija).—Lettland.
Lietuva (or Lietuvos).—Lithunia.
Magyar (Kir.) Posta.—Hungary.
Nederland.—Holland.
Norge.—Norway.
Oesterreich.—Ger. Austria (Republic).
Poczta Polska.—Poland.
Postes Ottomanes.—Turkey.
Republica Dominicana.—Dominican Republic (not the same as Dominica, British Colony).
S.H.S. Hrvatska.—Jugo-Slavia.
S. U'jong.—Sungei U'jong.
Sverige.—Sweden.



Russia 20r., 1922
Famine Relief issue



Turkey 2 par., 1913

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Stamp Collecting—(*continued from page* 945)

importance to proceed very slowly and gently, otherwise the stamp is almost certain to be torn and its value destroyed. Very frequently it is impossible to peel off the paper without ruining the stamp, and in such cases it must be floated off. Here again great care is required, because the bright colours of many modern stamps are secured by the use of aniline dyes and are quickly and seriously affected by damp. For this reason stamps should never be soaked in water. The best course is to lay them gently face upward on the surface of warm water or on damp blotting paper. The stamp and the paper must be separated immediately the moisture has penetrated the backing paper and before the back of the stamp has been wetted sufficiently to affect the colour on the front.



Hungary, 1 Kr. 1916

One of the greatest troubles encountered by every beginner is the indentification of his stamps. With English and British Colonial stamps he will be, of course, quite at home, and probably he will get along comfortably with foreign stamps the names of which are printed in English characters. When, however, names are printed in unfamiliar and weird-looking characters—Russian, Turkish, Arabic, Greek, etc.—trouble immediately arises. Japan, Korea, China, Siam, Afghanistan, and many of the Native Indian States have distinctive symbols of their own, while there are other stamps, even more exasperating to the beginner, upon which no indication of the country of origin is to be found.



Montenegro, 1 nov. Second centenary of Njegosch dynasty commemorative 1896

The catalogue forms the only secure guide to the identification of strange stamps until the collector gathers the necessary experience to identify the correct country without difficulty. After a while he will acquire a sort of instinct in this matter and will seldom be seriously at a loss.

In order to provide a little assistance in this direction we give in the centre panel of the first page of this article a list of some of the inscriptions that appear upon stamps that employ English characters for identification purposes. The illustrations used in this article also are designed to introduce enthusiasts to some of the less familiar types that are likely to cause trouble.

The Editor is always pleased to help in the solving of his stamp collecting readers' problems. If any collector is in doubt as to the identity or value of a stamp, he should not hesitate to send it along for inspection.



Bulgaria, 10 st. 1921

The 1929 Catalogues

It is appropriate that as we lay down our pen after inditing the closing sentences of our November article, there should be laid upon our desk the new editions of the catalogues upon the value of which we have laid so much stress in our advice to beginners.

The appearance of a new catalogue is one of the quiet joys of a stamp collector's life. So much that is new is chronicled for the first time—and even the most altruistic cannot refrain from checking up values.



Poland, 10 gr. 1925

Before us we have the Gibbons and Whitfield King issues for 1929 and from the latter we glean that in the course of the past year 1,738 new stamps have made their appearance. The total number of stamp issues to date has thus grown to 48,707. Europe has issued 14,712; Asia, 9,156; Africa, 11,270; America, 7,493; the West Indies, 3,074 and Oceania (including Australia and New Zealand), 2,552.

The Whitfield King catalogue is ideal for the young collector. It lists major varieties only and is free from details that while of the utmost importance to the specialist serve only to confuse the issue in the mind of the beginner. Even so the volume assumes bulky dimensions and contains nearly 900 pages and over 5,700 illustrations.

The Gibbons' catalogue crams an amazing amount of information into a small space, and is one of the most compact pieces of work that we know. The prices and general publication details are given in our stamp advertisement columns, and further information will be supplied gladly by the respective publishers.

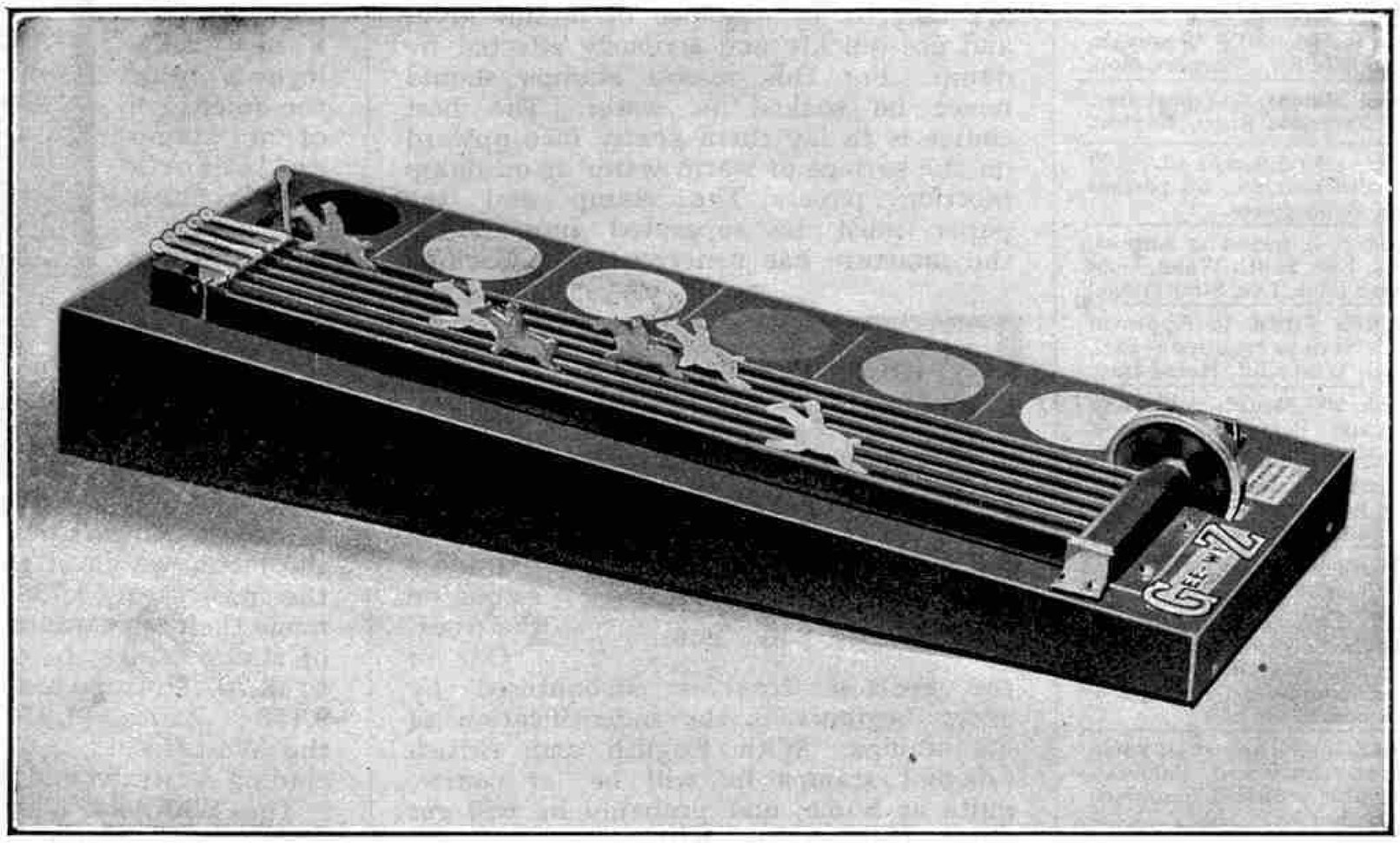
Several interesting innovations have been made in the new Gibbons' catalogue, notably in the system of pricing certain British Colonial stamps that exist in varying degrees of condition. As most of our readers know, the modern tendency is to collect only stamps that are in pristine condition. The "modern" movement ignores stamps that are heavily postmarked. As a consequence, catalogue values—representing usually the price of a specimen in average condition—have often been out of touch with the actual values of good and bad specimens. To remedy this position, the experiment of quoting prices covering the range between poor and fine specimens is being tried. If the differential system of pricing proves popular, it is proposed to extend it in future editions.

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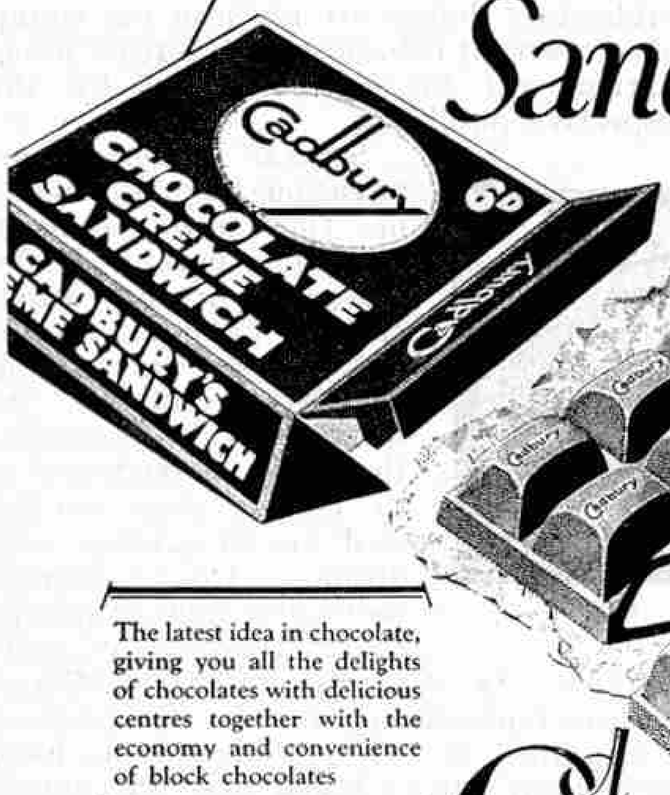
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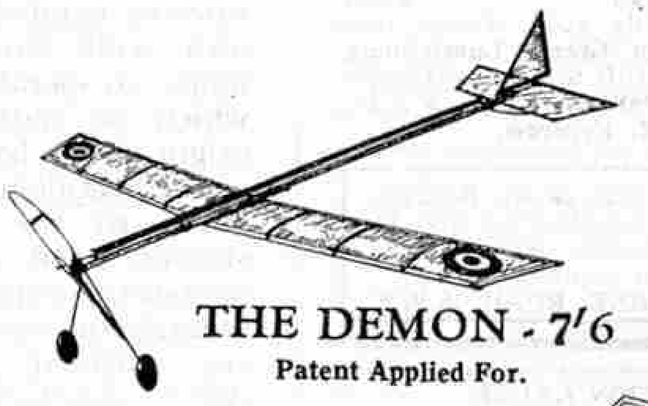
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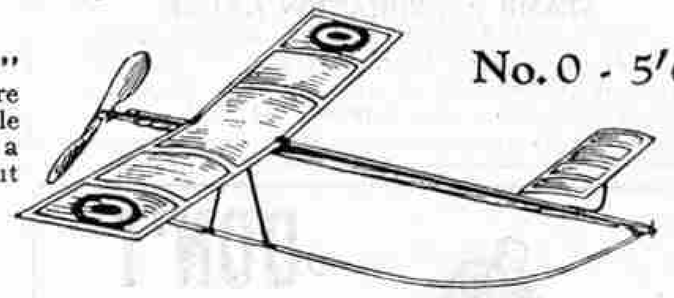


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Fireside Fun

THE END

A group of workmen were discussing the evolution and origin of man. One of the party remained silent, and a companion turned to him and demanded his opinion.

"I ain't goin' to say," he replied, doggedly. "I remember as 'ow Henry Green and me threshed that out once before, and it's settled as far as I am concerned."

"But what conclusion did you come to?"

"Well," he said, slowly, "we didn't arrive at the same conclusion; Henry, he arrived at the 'orspital an' me at the police station."

* * * *

Milkman: "Looks like rain."
Customer: "Yes, it does, but it has a faint flavour of milk."

* * * *

"What became of that hired man you got from the city?"

"He used to be a chauffeur and one day he crawled under a mule to see why it wouldn't go."

* * * *

RATHER FISHY!

The movie exhibitor had just insured his theatre against fire. As he signed his name he turned to the insurance agent and asked: "What would I get if my theatre was to burn down to-morrow?"

"Oh, I should say about ten years," replied the insurance man.

* * * *

A SECRET

"Look here, you old rascal, why didn't you tell me this horse was lame before I bought him?"

"Well, the feller that sold him to me didn't say nothin' about it, so I thought it was a secret."

* * * *

NOT FAIR



One day two Irishmen had a wager as to who would catch the biggest fish, when suddenly one of them happened to tumble into the water. "Hi!" cried Mike angrily, "sure, if you're going to dive for them I'm going home!"

* * * *

Resident: "Are you opening this part of the road again now you have just filled it in?"
Workman: "Well, sir, this is our last hope of finding the foreman's pie-dish."

* * * *

NOT AT ALL

A mild little man was waiting in one of the hotel's telephone booths for the operator to take notice of him.

At last the girl deigned to look in his direction.

"Are you wanting a number?" she asked.

"Oh, no, miss," was the reply. "I just stepped in here to develop a photograph."

THE OTHER ONE

Mother: "You've been fighting with the boy next door again. I'll have to buy you a new suit, now."
Tommy: "Gee, you oughta see him. His mamma will have to buy a new boy."

* * * *

A.: "I know a girl who plays the piano by ear."
B.: "That's nothing; I know a man who fiddles with his whiskers."

* * * *

Sonny: "Yes, dad, I'm a big gun at College."
Father: "Well, then, why don't I hear better reports."

* * * *

DESTITUTE!



Sarcastic Old Golfer: "Do you think it's safe for you to wear plus-fours, young man?"
Thin-legged Youth (surprised): "Why not?"
S. O. G.: "You might be arrested for having no visible means of support."

* * * *

Country Policeman (at scene of murder): "You can't come in here."
Reporter: "But I've been sent to do the murder."
"Well, you're too late, it's been done."

* * * *

THE POCKET FARMER

An old farmer and a young man were arguing about scientific methods of farming.

"The time is coming," said the young man, "when I shall be able to carry the fertiliser for a whole field in one of my pockets."

"Yes," said the old farmer disdainfully," and you will be able to carry the whole of the crop in another pocket."

* * * *

Master: "What was the ruler of Russia called?"
Class: "Czar."
"And his wife?"
"Czarina."
"The children?"
"Czardines!"

* * * *

Patrick (in 'phone booth): "Give me East 2000."
Operator: "Speak a little louder, please, Sir."
"East 2000!"
"A little louder, please, sir."
"Begorrah, an' if I could be shoutin' a little louder, it's no 'phone I'd be needin' at all!"

* * * *

Fond Mother: "Do you know my son Johnny?"
Bill: "Do I! Why, we slept together in the same French class."

* * * *

Sergeant (angrily): "Button up that coat!"
Married recruit (absent-mindedly): "Yes, my dear."

* * * *

Maiden Aunt: "And what brought you to town, Henry?"
Henry: "O, well, I jus' come to see the sights, and thought that I'd call on you first."

* * * *

"And will you walk along to the station with me, Douglas?" asked the visitor.

"I'm afraid I can't," replied the son of the house apologetically.

"Why? You surely are not tired?"

"Oh, no; but we're having dinner as soon as you go."

ONE FOR PAT

An American and an Irishman were out riding together and were passing the County gaol when suddenly the American said:

"Now, if the prison had its due where would you be, Pat?"

"Riding alone!" was Pat's terse reply.

* * * *

Old Gentleman: "Why do you always pull your barrow instead of pushing it?"
New Gardener: "'Cause I 'ates the sight of the blooming thing."

* * * *

Mother (having read aloud an exciting story): "I shouldn't like to be eaten alive by savages, would you, Bunty?"
Bunty (who has had her share of doctoring): "It might not be so bad, mummy, if you had an anæsthetic." *Daily Mirror.*

* * * *

Aeroplane Pilot (to nervous friend): "Gad! We've discovered it at last!"
Friend: "Discovered what?"
Pilot: "Perpetual motion—I can't stop her."

* * * *

First Labourer: "How would you like to be up there with that aeroplane?"
Second Labourer: "I'd sooner be up there with it than without it, anyway!"

* * * *

ONE MISSING

Teacher: "I must write your mother a note, thanking her for this lovely apple."
Johnnie: "Would you mind thanking her for two, please?"

* * * *

HIS CHOICE

"Come, come, you shouldn't refuse to lend me money. One friend should always be willing to help another."

"I know, but you insist on always being the other."

* * * *

AMPLE KNOWLEDGE

He had just taken a house in the country, and was going round the stables and kitchen garden with the handy man. The man's knowledge was proving rather limited, and when they came to the beehives the new owner was getting a little annoyed.

"Do you know anything about bees?" he asked sharply.

"Yes, they sting," was the helpful reply.

* * * *

Mother: "Why were you whipped at school, Sammy?"
Sammy: "'Cos teacher told us to write an essay on the 'Result of Laziness,' and I sent up a blank sheet of paper."

* * * *

A SUBTLE DISTINCTION



A diminutive nigger-boy was endeavouring to eat an over-size in melons, much to the amusement of a white onlooker.

"Too much water-melon, eh, Sambo?" he said.

"No, sah," said Sambo, "Not enough niggah!"

* * * *

Waiter: "Er-ahem; the amount put down in the bills does not include the waiter, sir."
Diner: "Well, I didn't eat a waiter."

* * * *

"The doctor said he would have me walking again in three weeks."

"Well, did he do it?"

"He did, I had to sell my motor car to pay his bill."

BRITISH AND GUARANTEED

ROLLING STOCK

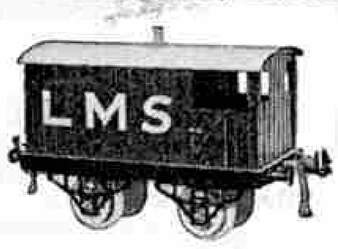
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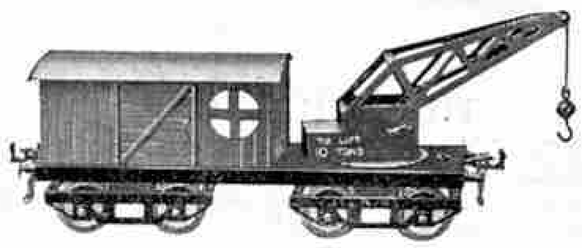
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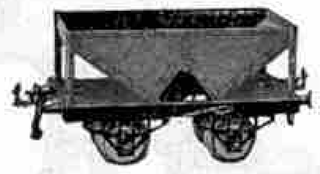
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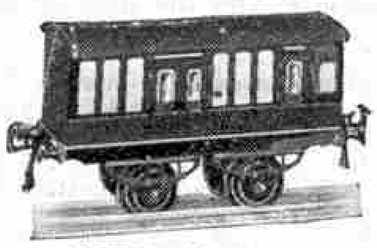
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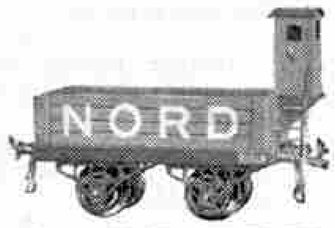
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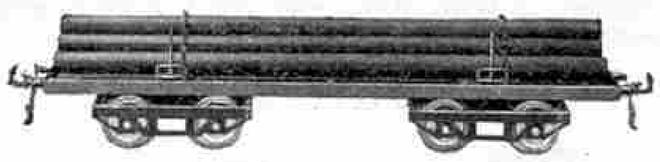
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***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price **2/6**



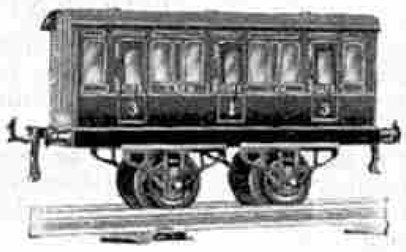
WAGON, FRENCH TYPE
Lettered Nord. Highly finished in colours.
Price **3/3**



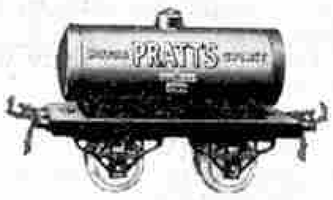
***LUMBER WAGON No. 2**
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only.
Price **4/-**



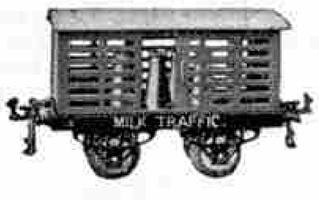
PETROL TANK WAGON "B.P."
Finished in Cream.
Price **2/6**



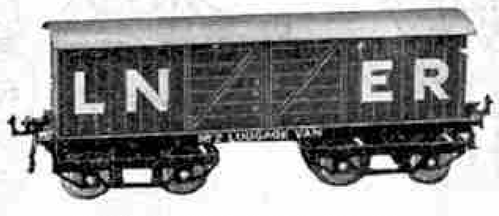
***HORNBY PASSENGER COACH No. 0-1**
As supplied with Hornby No. 0 and No. 1 Passenger Sets ... Price **2/6**



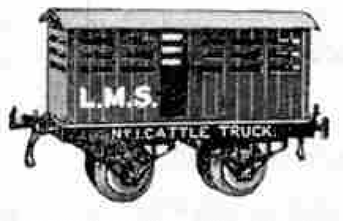
PETROL TANK WAGON "PRATTS"
Finished in green. Price **2/6**



***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans.
Price **3/6**



***LUGGAGE VAN No. 2**
Finished in two shades of blue. Fitted with double doors. Suitable for 2-ft. radius rails only. Price **5/9**



***CATTLE TRUCK No. 1**
Fitted with sliding door. Very realistic design.
Price **3/6**



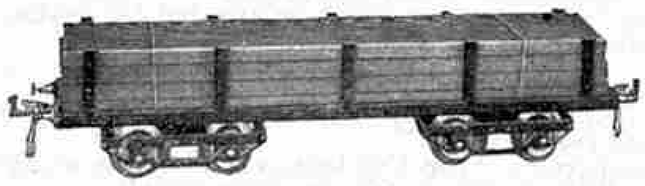
PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**



JACOB'S BISCUIT VAN
Finished in crimson lake, with opening doors.
Price **3/6**



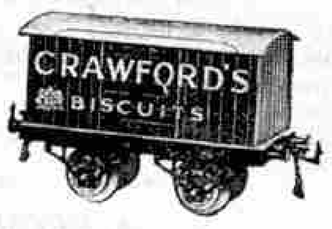
CARR'S BISCUIT VAN
Finished in blue, with opening doors.
Price **3/6**



***TIMBER WAGON No. 2**
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**



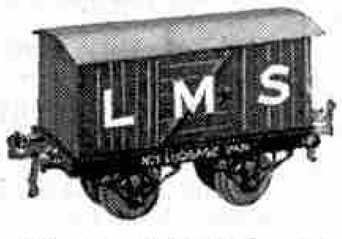
SECCOTINE VAN
Beautifully finished in blue, with opening doors.
Price **3/6**



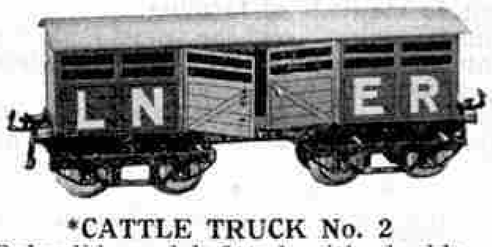
CRAWFORD'S BISCUIT VAN
Finished in red, with opening doors. Price **3/6**



***CRANE TRUCK**
Finished in brown and blue. Price **3/6**



***No. 1 LUGGAGE VAN**
With opening doors.
Price **3/6**



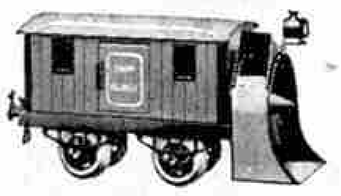
***CATTLE TRUCK No. 2**
Splendid model fitted with double doors. Suitable for 2-ft. radius rails only. Price **5/9**



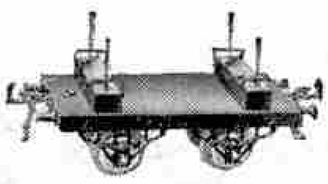
***GUNPOWDER VAN**
Finished in red, with opening doors. Price **3/9**



***GAS CYLINDER WAGON**
Finished in red, lettered gold. Price **2/6**



***SNOW PLOUGH**
With revolving plough driven from front axle.
Price **5/6**



***LUMBER WAGON No. 1**
Fitted with bolsters and stanchions for log transport.
Price **2/-**



***TROLLEY WAGON**
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **5/6**



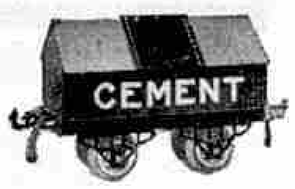
***TIMBER WAGON No. 1**
Beautifully enamelled in green and red. Price **1/9**



BRAKE VAN, FRENCH TYPE
Lettered Nord. Beautifully finished in colours. Opening doors. Price **4/-**



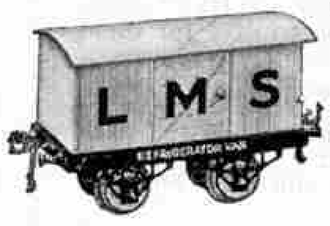
SIDE TIPPING WAGON
Excellent design and finish.
Price **2/6**



***CEMENT WAGON**
Finished in red.
Price **3/-**



HORNBY PULLMAN COACH No. 3
As supplied with No. 2 and No. 3 Train Sets. Suitable for 2ft. radius rails only ... Price **11/6**



***REFRIGERATOR VAN**
Beautifully enamelled with opening doors.
Price **3/9**



ROTARY TIPPING WAGON
Finished in orange.
Price **3/-**

Lettered L.M.S., N.E., S.R. or G.W.

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL

STATIONS AND ACCESSORIES

Hornby Series

The Hornby System consists of a comprehensive range of Stations, Platforms and Accessories with which the most elaborate model Railway Terminus or Goods Yard may be constructed. Every item is exceptionally well designed and is carefully modelled on its prototype in real life. A selection of the various components included in the Hornby Series of Stations and Accessories is illustrated below.



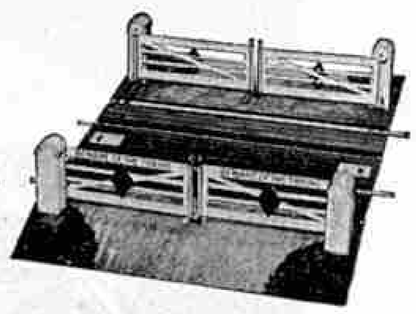
RAILWAY STATION No. 2. Excellent model, well designed and finished. Constructed in three sections which are detachable. Dimensions: Length 2-ft. 9-in., breadth 6-in., height 7-in. ... ... Price **10/–**

PASSENGER PLATFORM. Length 16¾-in., width 3-in. This platform may be connected to the main station or used separately. The interlocking device at each end enables a number of these platforms to be joined together ... ... Price **3/6**

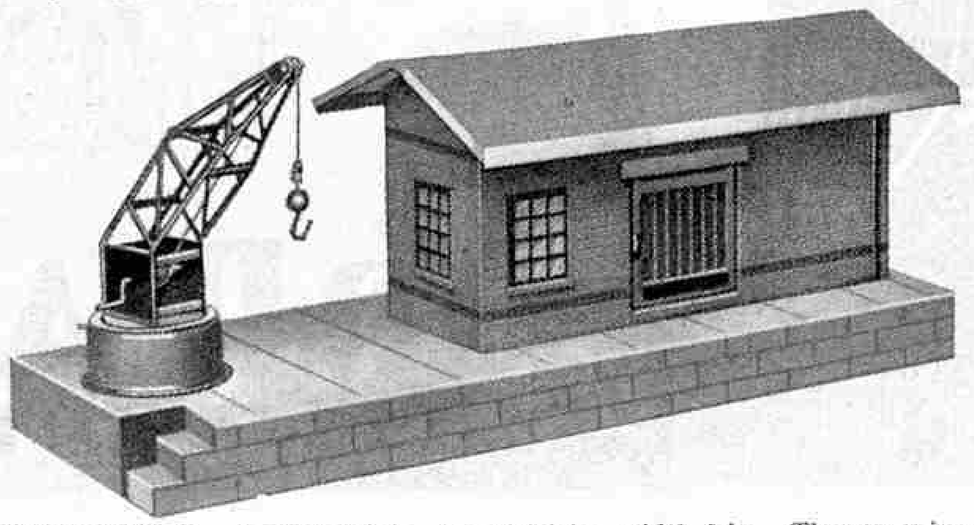
White paled fencing as supplied with the Passenger Platform may also be purchased separately ... ... Price per length **6d.**



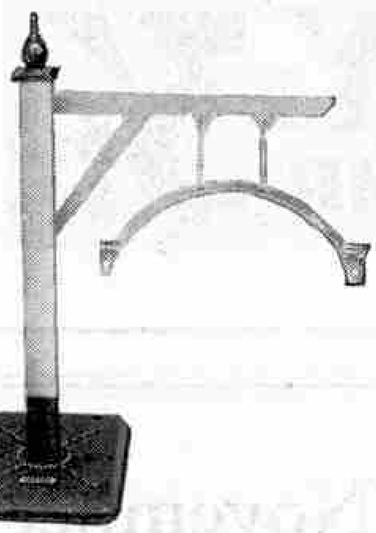
SIGNAL CABIN No. 2
Dimensions: Height 6½-in., Width 3½-in., Length 6½-in. Finished in colours and lettered "Windsor." Roof and back open to allow a signal lever frame to be fitted inside cabin, if desired, and operated. Price **6/6**



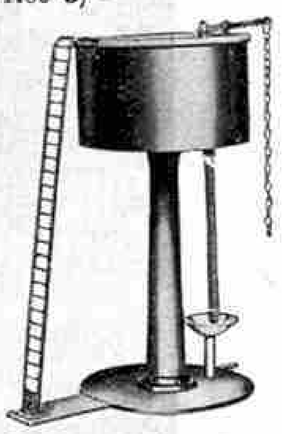
LEVEL CROSSING No. 2
Beautifully designed in colours. Measures 11½ × 7¼-in. with Gauge 0 rails in position.
Price **5/–**



GOODS PLATFORM. Length 16¾-in., height 6¾-in., width 6-in. The crane is enamelled in bright red and is fitted with a crank and ratchet mechanism for controlling the load.
Price **10/6**







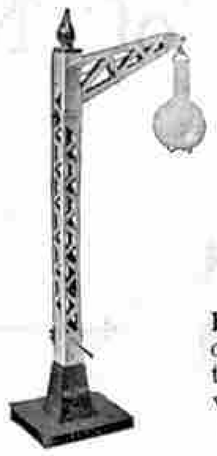
WATER TANK
Brightly coloured. Stands 8½-in. high. Fitted with flexible tube and valve lever.
Price **6/6**

ISLAND PLATFORM. Length 32¼-in., height 6¾-in., width 3-in. The ramps at either end are detachable. Attractively coloured in green, blue and white ... ... Price **7/6**

Ramps similar to those fitted to the Island Platform may be purchased separately.
Price per Pair **1/6**

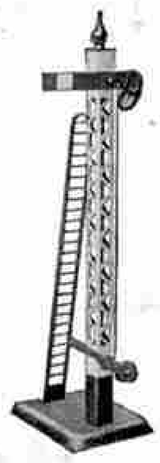
TELEGRAPH POLES
Price per pair **3/6**

LOADING GAUGE
Price **1/9**





RAILWAY STATION No. 1. A well-made model, richly finished in colours. By placing one or more of these Stations at intervals along the track, and using the Railway Station No. 2 as the main terminus, a very realistic effect is given to a miniature lay-out. Dimensions: Length 16¾-in., width 6-in., height 9-in. .. .. Price **5/–**



SIGNAL No.2
"Home" or "Distant"
Price **2/6**



TUNNEL
Realistic and finished in colours ... Price **7/6**

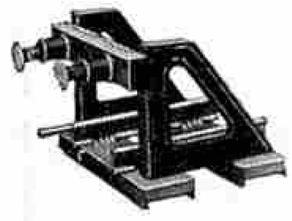


TURN-TABLE No. 1 2/6
TURN-TABLE No. 2
(As Illustrated) **4/–**

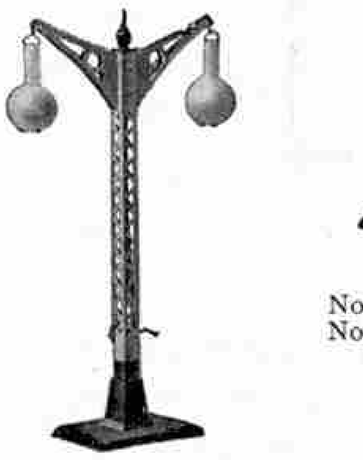
LAMP STANDARD No. 1 (SINGLE)
A 4-volt bulb may be fitted into the globe. Price **3/–**



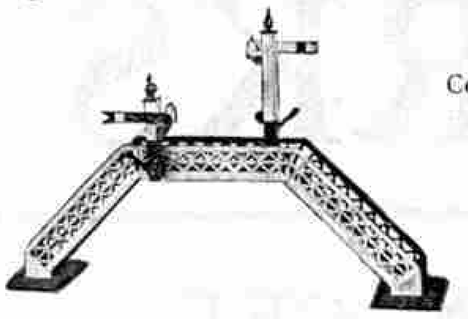
VIADUCT. Price **7/–**
ELECTRICAL VIADUCT. Price **8/–**
Centre Section for Viaduct. Price **4/6**
Centre Section for Electrical Viaduct. Price **5/–**



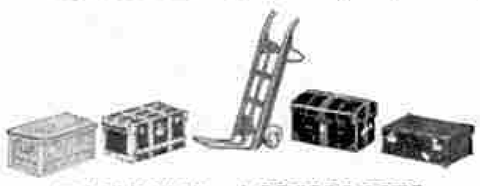
BUFFER STOPS No. 1 (SPRING)
Price **1/–**



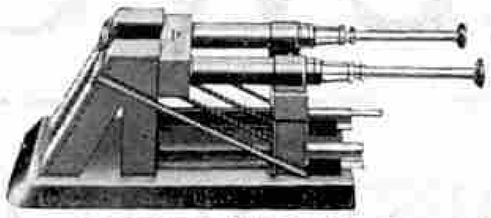
LAMP STANDARD No. 2 (DOUBLE)
Four-volt bulbs may be fitted into the globes.
Price **4/–**



FOOTBRIDGE
No. 1. Without Signals ... Price **3/6**
No. 2. With detachable Signals ,, **6/–**
Signals only ... ... per pair **2/9**



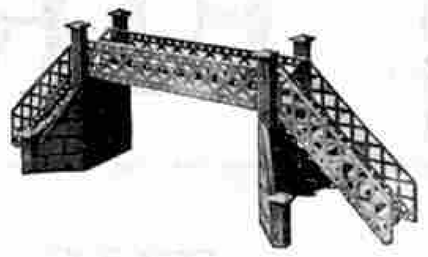
RAILWAY ACCESSORIES
No. 1. Miniature Luggage and Truck.
Price per set **1/6**



BUFFER STOPS No. 2 (HYDRAULIC) Price **5/–**



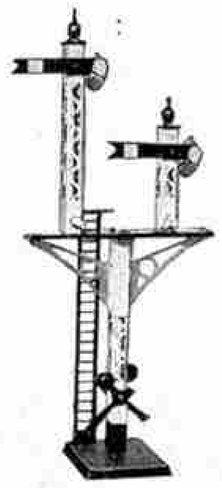
RAILWAY ACCESSORIES
No. 3. Platform Machines, etc. Price per set **1/6**



LATTICE GIRDER BRIDGE
Constructional type. Strong and well proportioned.
Price **9/6**

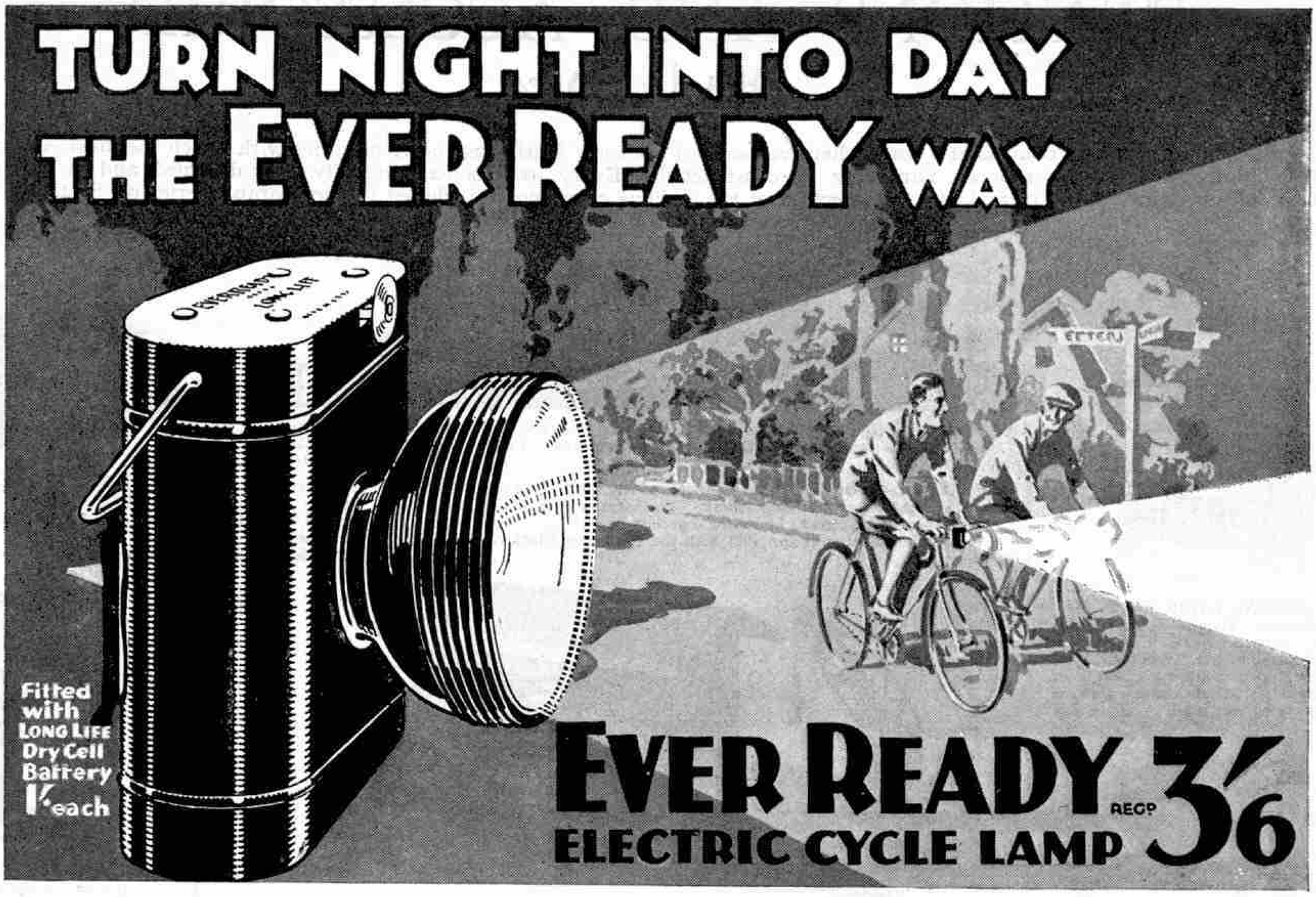


RAILWAY ACCESSORIES
No. 2. Milk Cans and Truck.
Price per set **1/6**



JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. Very realistic model standing 14-in. in height.
Price **5/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL



Remember! Remember! The Fifth of November!

AND DON'T FORGET TO GET

BROCK'S

"CRYSTAL PALACE"

FIREWORKS

THE BEST YOU CAN GET

MADE ONLY BY

C. T. BROCK & CO.'S "CRYSTAL PALACE" FIREWORKS LIMITED

The Oldest and Largest Makers in the World Established in the 17th Century

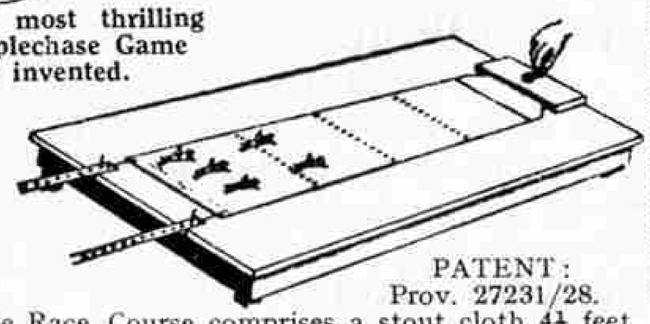


Suggestions from Treasureland



ESCALADO

The most thrilling Steeplechase Game ever invented.



PATENT: Prov. 27231/28.

The Race Course comprises a stout cloth 4½ feet long and 12 inches wide, provided with obstacles or fences, and with spring and clamp ends adjustable for any dining table.

Horses are cast in metal and variously coloured.

MADE IN THREE QUALITIES:—

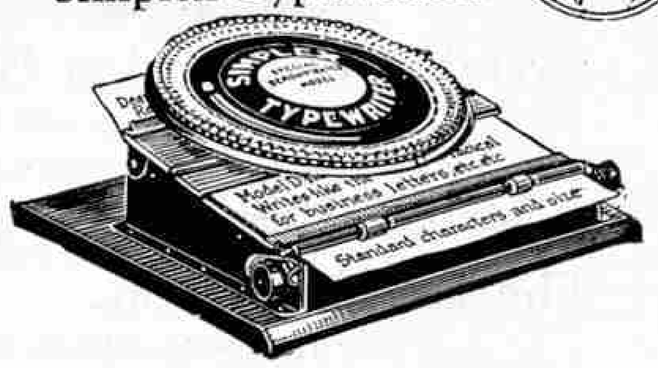
7/6 **10/6** **21/—**

As above, better Quality. Size 72″×18″

We illustrate on this page a small selection from our extensive range of good things for boys. We always carry complete stocks of Meccano, Hornby Trains and Accessories, Hobbies Boats, Lott's Bricks, etc.

We are sole Birmingham and District Agents for Bassett-Lowke.

Simplex Typewriters



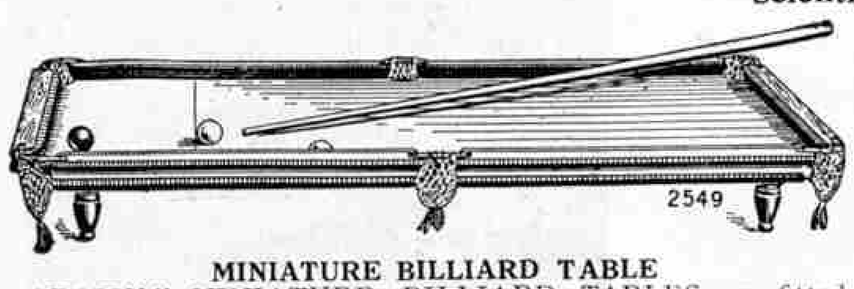
Enac Model writes in sight and each takes any length paper, card or envelope.

Simplex Model E, 36 characters. Takes 5 inch width paper, card or envelope. Simple and practical for the beginner, for school-work, for home or business uses, addressing envelopes, tags, etc. ... ... Price **5/-**

Other Models **F 10/-, G 15/-, H 20/-, C 12/6.**

DAISY" MINIATURE BILLIARD AND BAGATELLE TABLES

Scientific reproduction of full-sized Tables

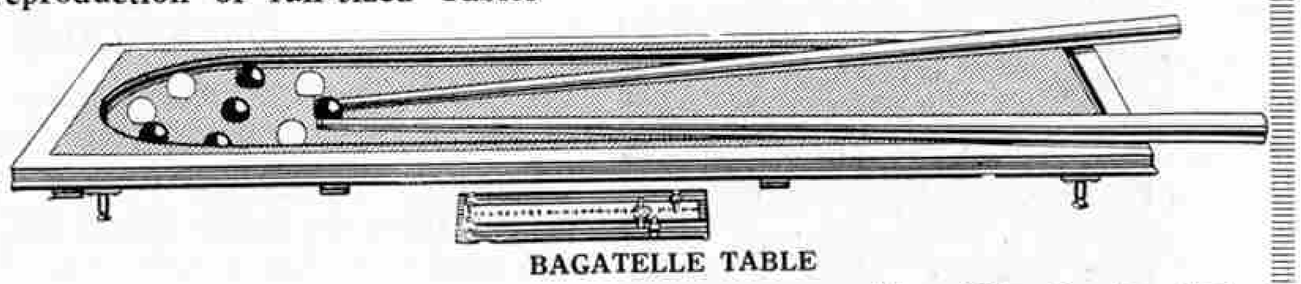


MINIATURE BILLIARD TABLE

"DAISY" MINIATURE BILLIARD TABLES are fitted with adjustable feet to ensure a perfect level. Each table is complete with two cues, marking board, chalk, rules and three composition balls.

Size.	Ball.	Cue.	Price.
3 ft. 6 in.	1¼ in.	3 ft. 3 in.	**35/-**
4 ft.	1¼ in.	3 ft. 5 in.	**45/-**
4 ft. 6 in.	1⅜ in.	3 ft. 7 in.	**60/-**
5 ft.	1⅜ in.	3 ft. 9 in.	**80/-**

Carriage Paid.



BAGATELLE TABLE

Size: 4 ft. 3 in. by 1 ft. 6 in. ... ... Price **42/-** *Carriage Paid.*

Complete with two cues, nine balls, marking board, chalk, rules, etc.

ACCESSORIES

The following additional Accessories for "DAISY" Billiard Tables are also available:

SNOOKER BALLS. Complete set of 17 balls, with triangle:

1¼ in. for 3 ft. 6 in. and 4 ft. tables **19/6**

1⅜ in. for 4 ft. 6 in. and 5 ft. tables **28/-**

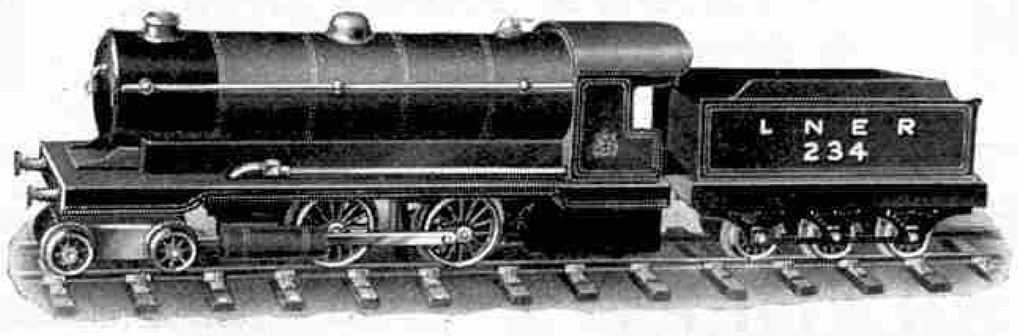
British Locomotives



31 E. Reversing Tank Electric Locomotive. With powerful 4-volt motor. Length 8½ ins. L.M.S. or L.N.E.R. colours. Gauge 0–1¼ ins. Fully guaranteed. Price **25/-** Post Free.

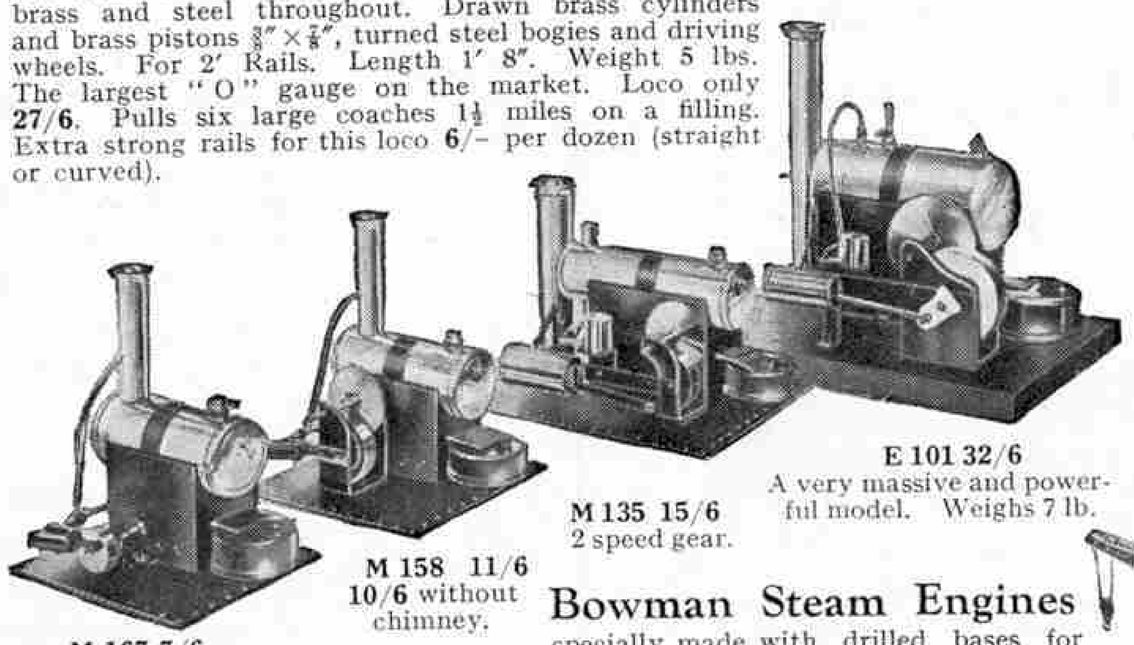
35 E. Reversing Bogie Tank Electric Locomotive. The popular 4–4–0 type, fitted with powerful 4 to 6-volt motor. Length, 10½ ins. Gauge 0–1¼ ins. L.M.S. or L.N.E.R. colours. Price **33/6.** Post Free.

Hornby Electric Rails suitable for these Locos.
Straight, 7/- per doz.
Curved, 8/- per doz.



EXPRESS STEAM LOCO AND TENDER (Mod. 234) 35/- Post Free.

The same size and power as usual **£6** models. Solid brass and steel throughout. Drawn brass cylinders and brass pistons ⅜″×⅞″, turned steel bogies and driving wheels. For 2′ Rails. Length 1′ 8″. Weight 5 lbs. The largest "O" gauge on the market. Loco only **27/6**. Pulls six large coaches 1½ miles on a filling. Extra strong rails for this loco **6/-** per dozen (straight or curved).



M 167 7/6
6/6 without chimney

M 158 11/6
10/6 without chimney.

M 135 15/6
2 speed gear.

E 101 32/6
A very massive and powerful model. Weighs 7 lb.

ALL POST FREE.

these models are guaranteed to give satisfaction.

Bowman Steam Engines

specially made with drilled bases for building into Meccano models. The most powerful engines in the world at the price. Solid brass and steel throughout. All Send us your orders at once.

British Locomotives



25 S. O Gauge Steam Loco. Brass boiler, brass oscillating cylinders, anti-friction pistons, automatic oiler, wind guards. Will steam about 15 minutes with one filling. L.M.S. or L.N.E.R. Colours. Price **12/6.** Post Free.

30 S. Strong Heavy Steam Loco. O Gauge, brass boiler, brass oscillating cylinders, anti-friction pistons, automatic oiler, wind guards. Will run for half-mile with one filling. Price **21/-.** Post Free.

Hornby Rails suitable for these Locos.
Straight rails, 4/- per doz.
Curved rails, 4/6 per doz.



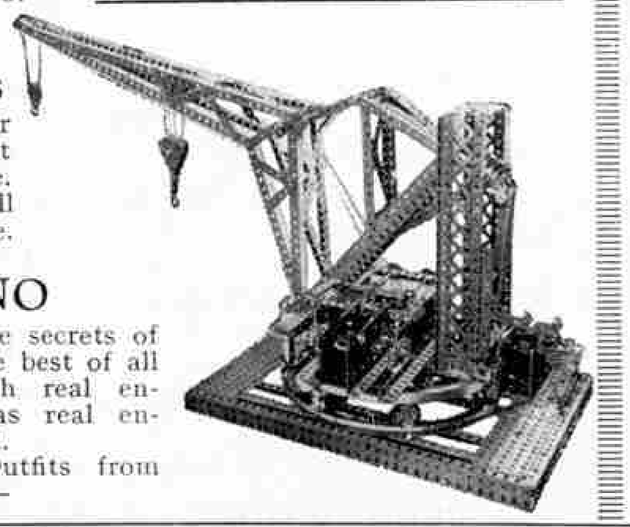
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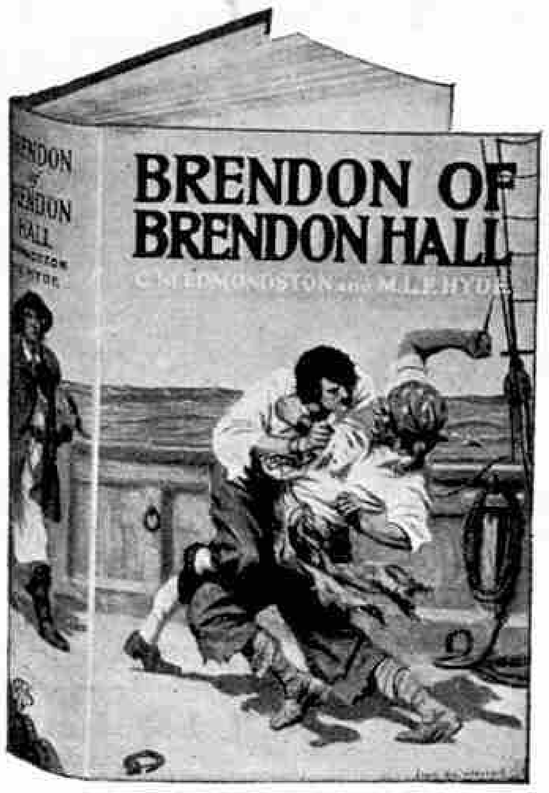
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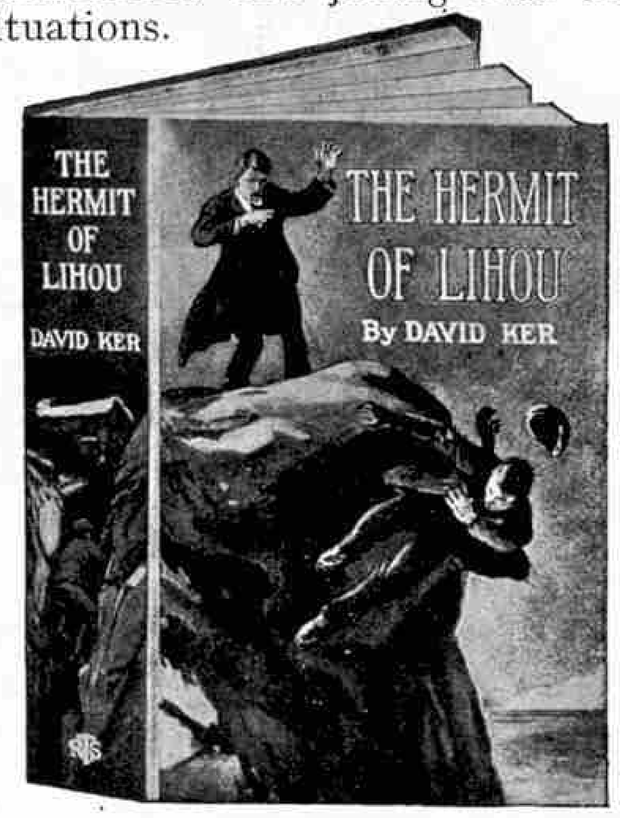
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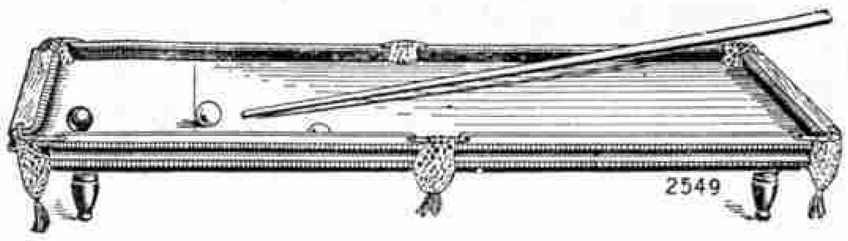
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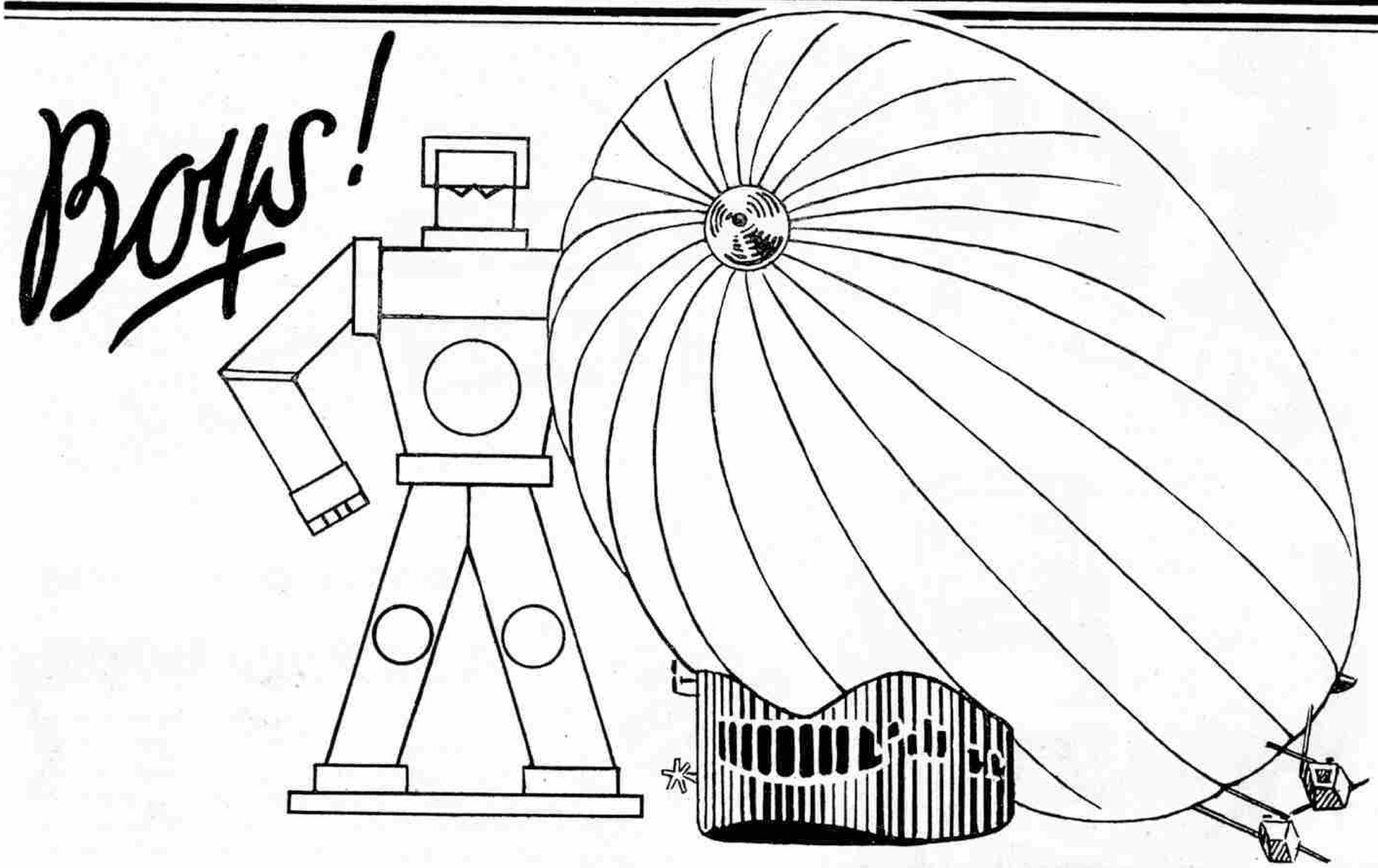
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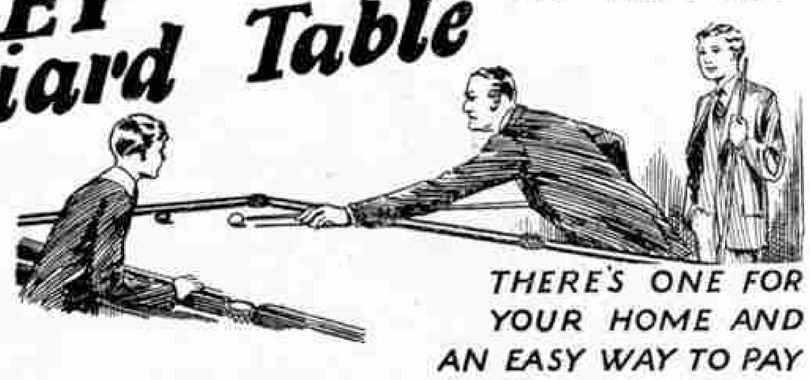
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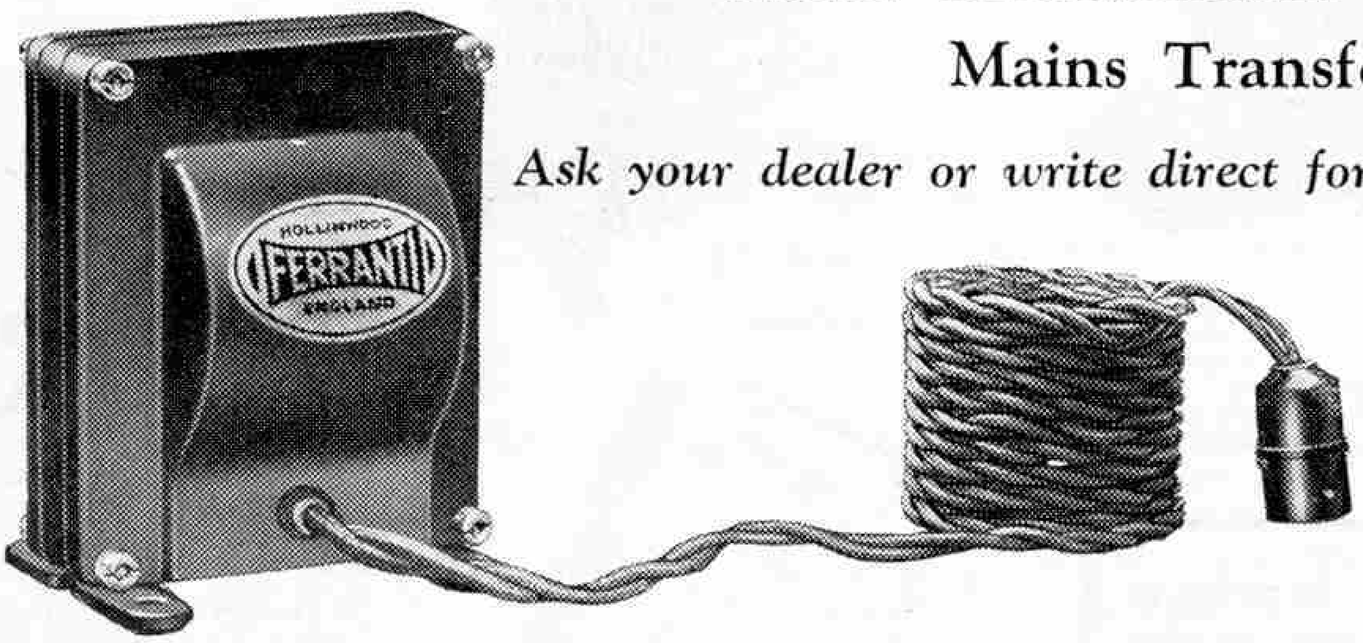
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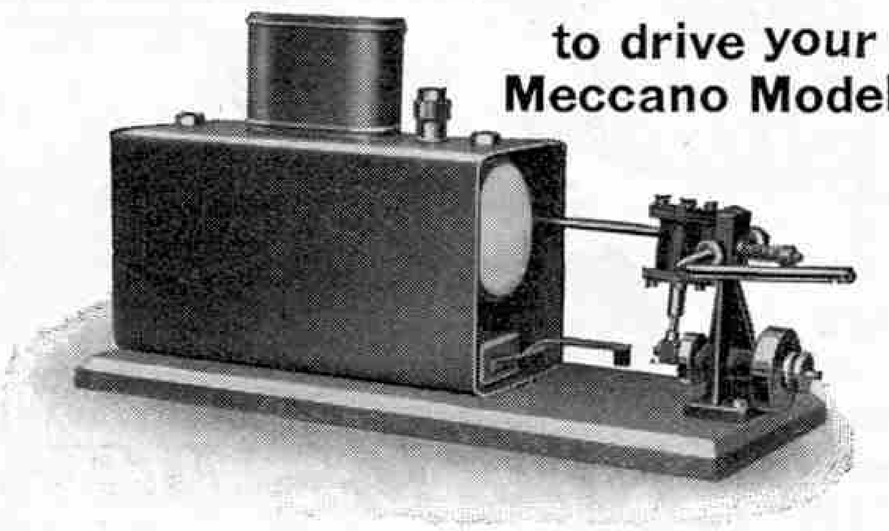




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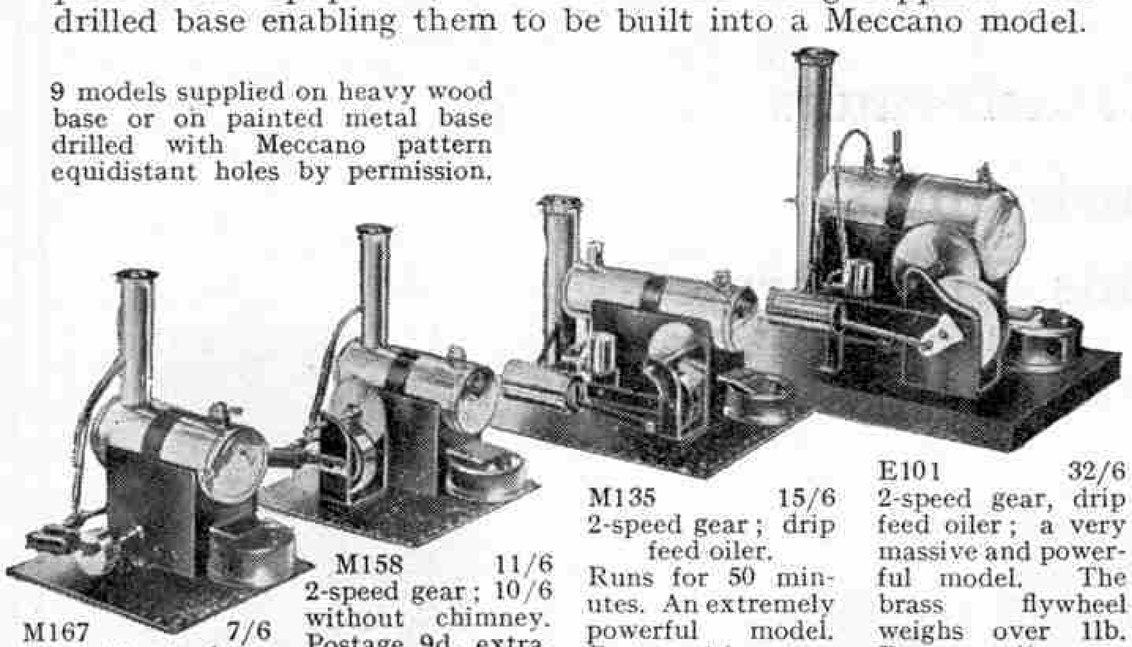
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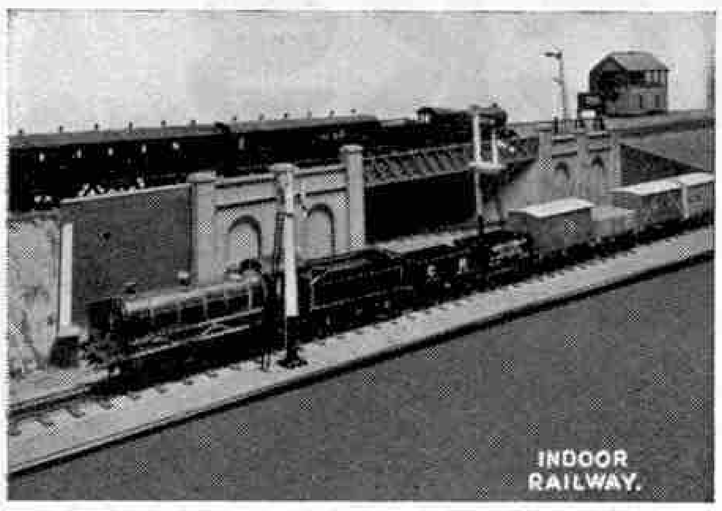


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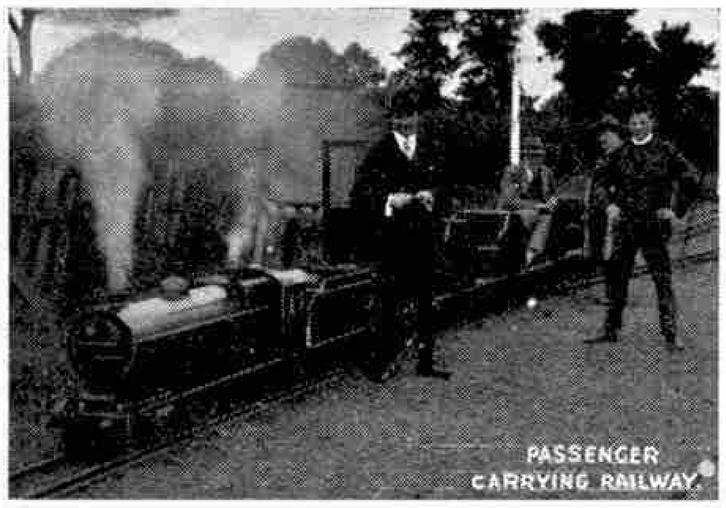

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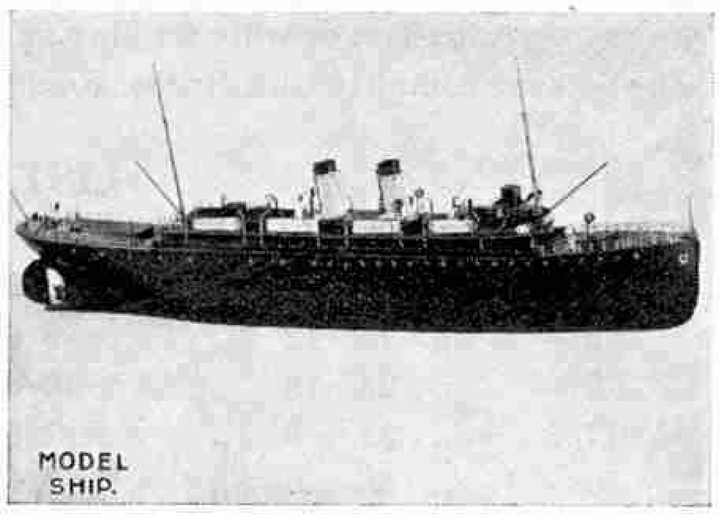
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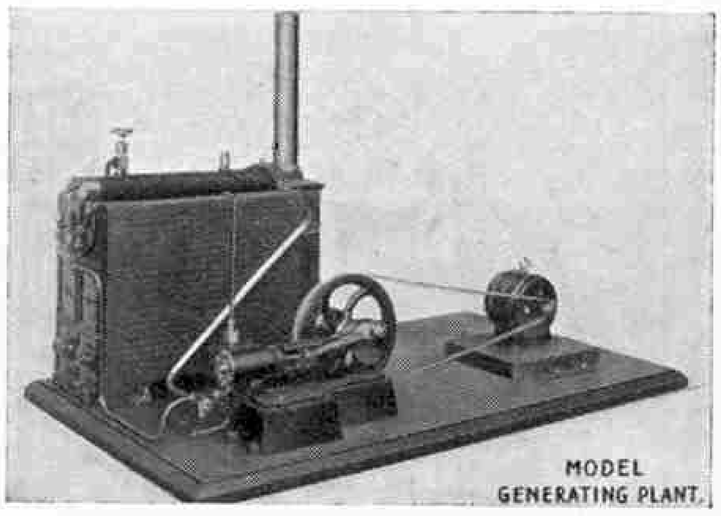

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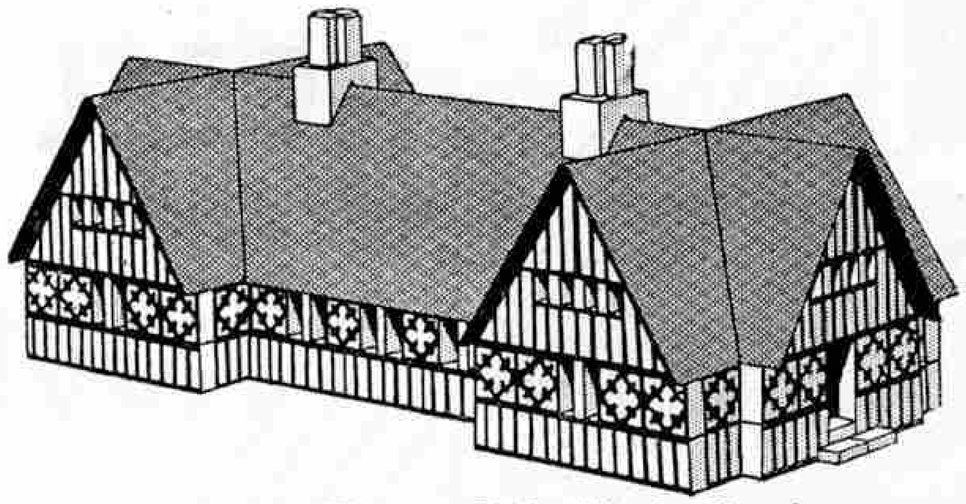

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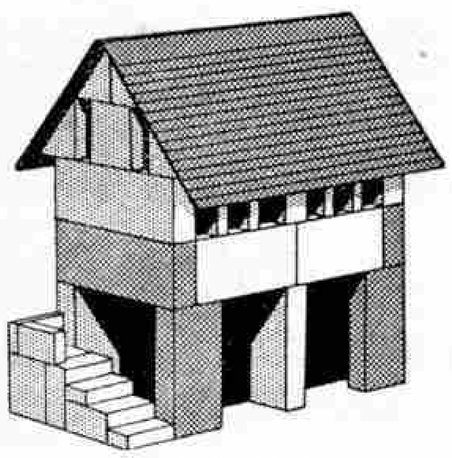
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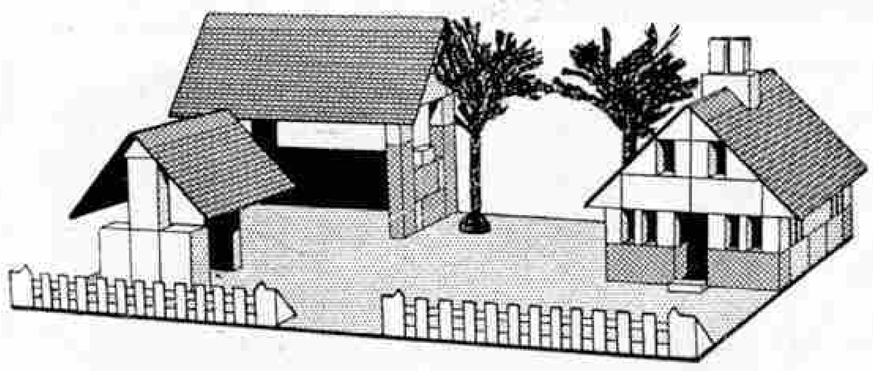
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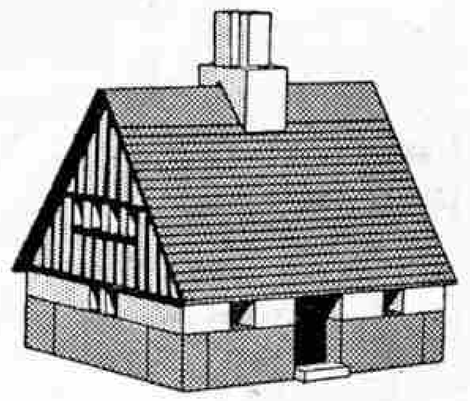
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,,	4	84	,,	30/–	,, 4a	6 ,,	7/6

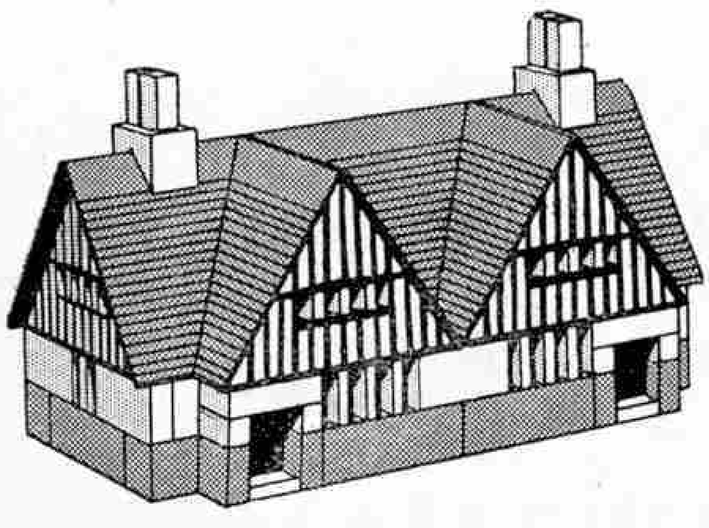
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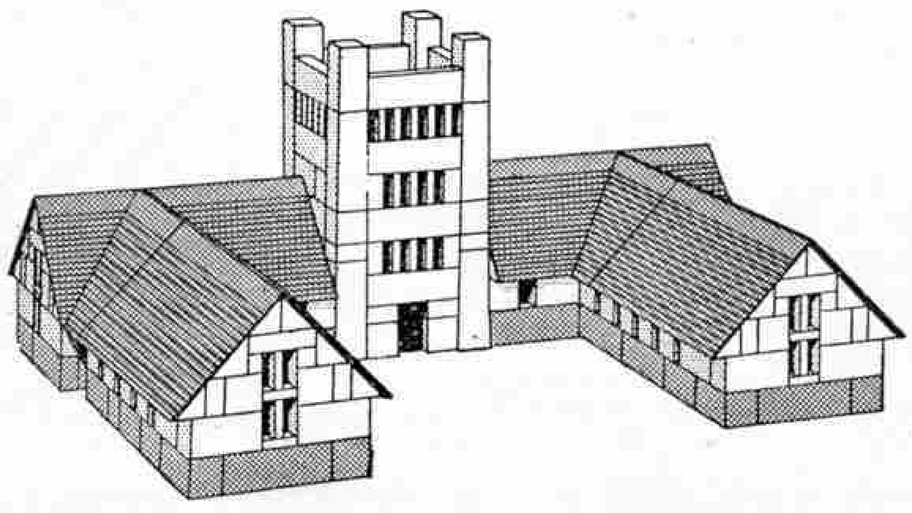
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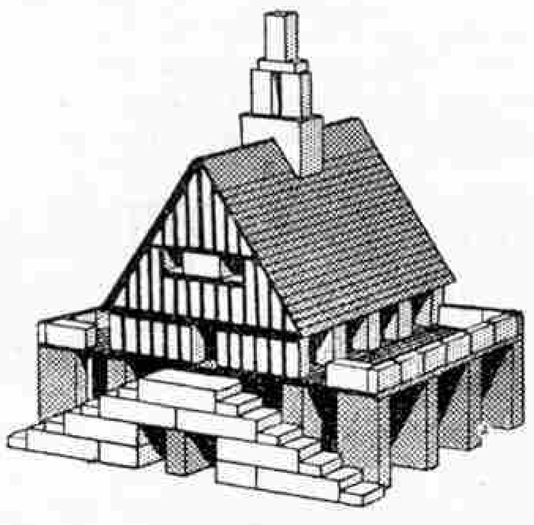
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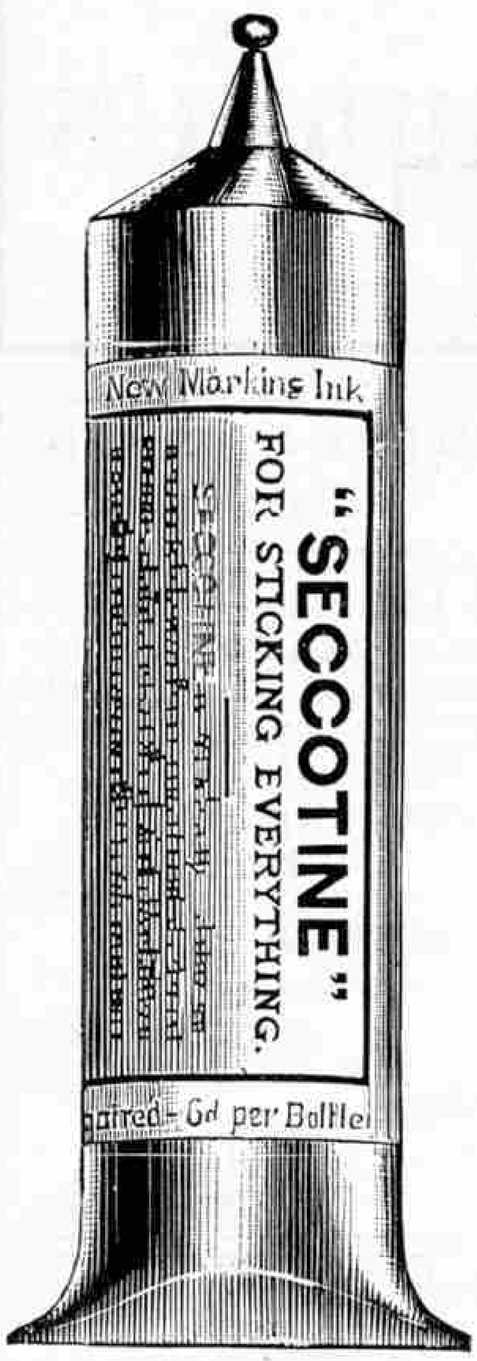
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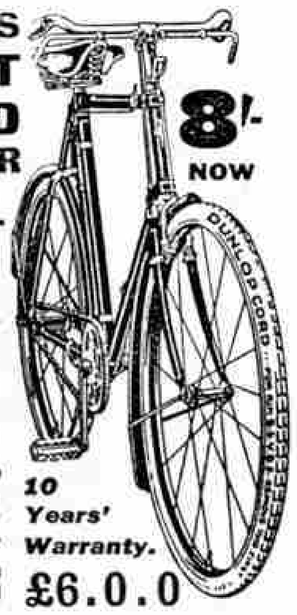
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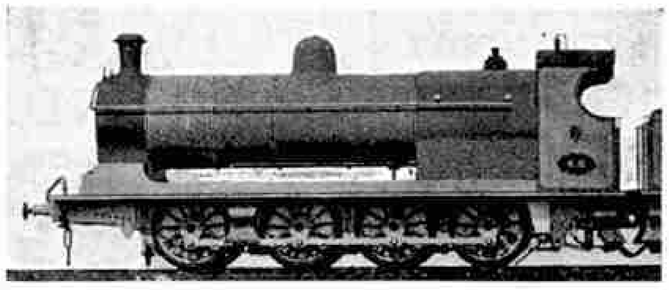
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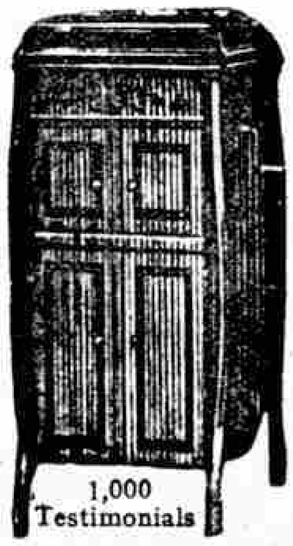
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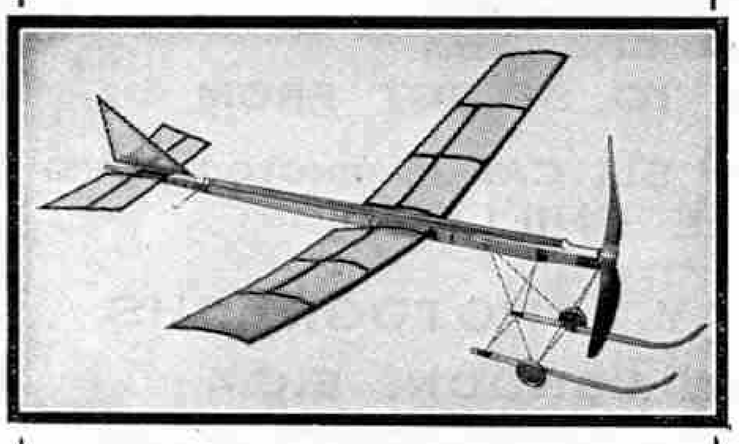
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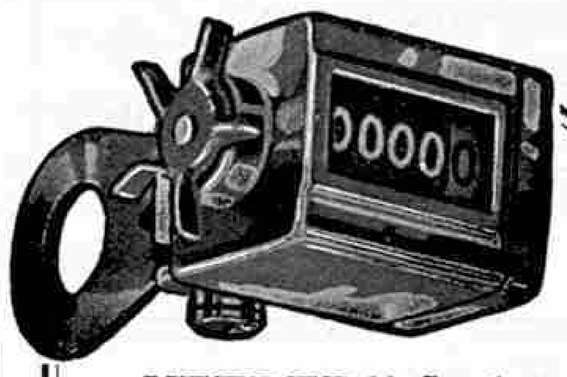
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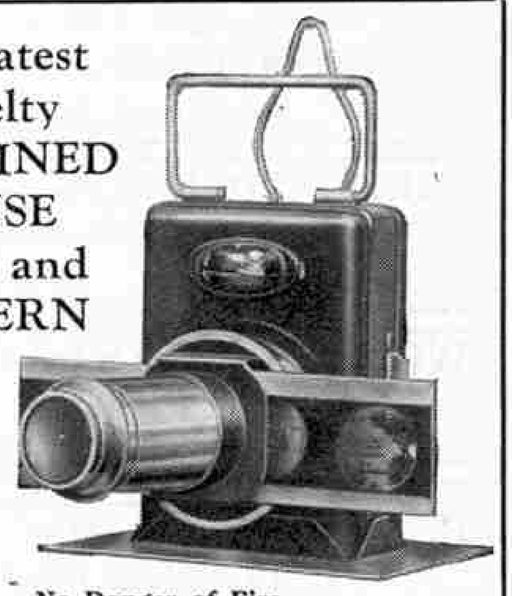
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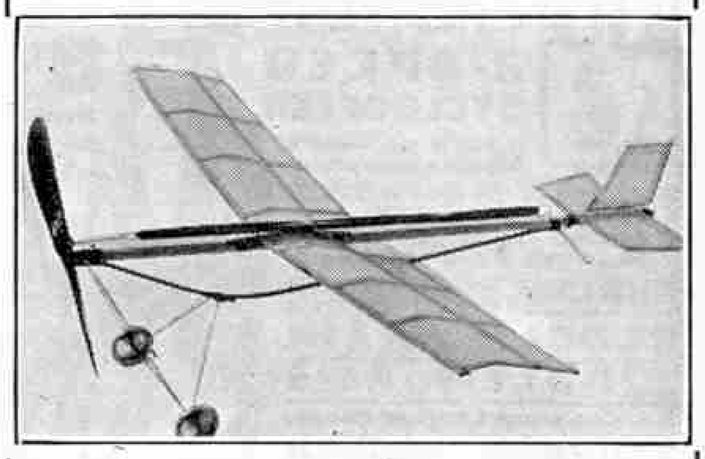
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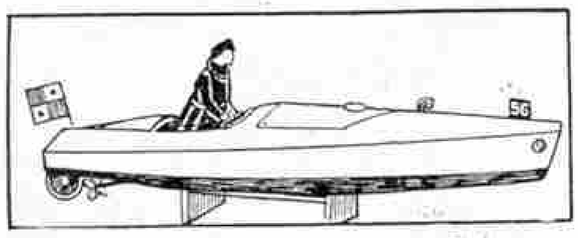
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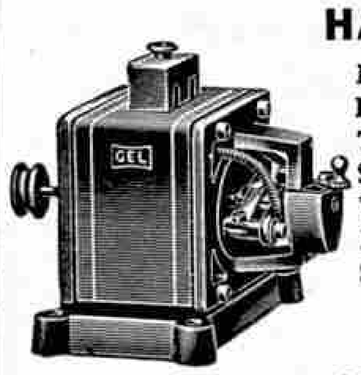
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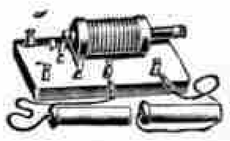
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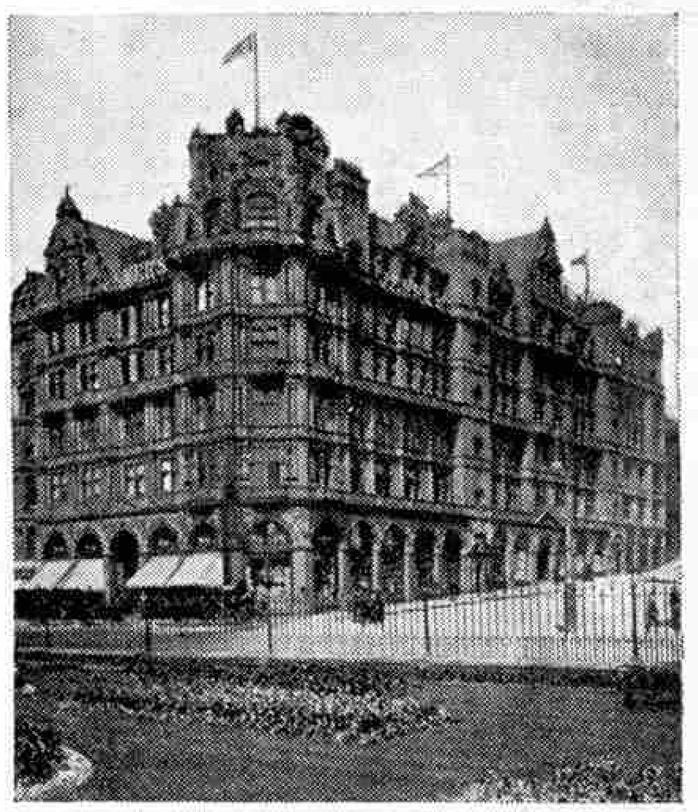
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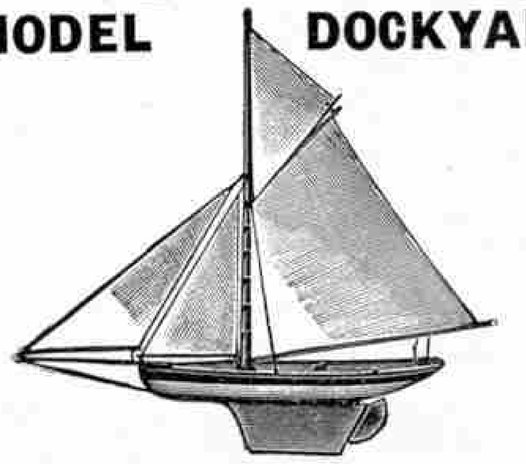
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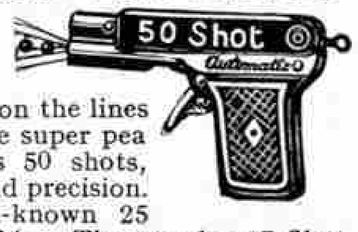
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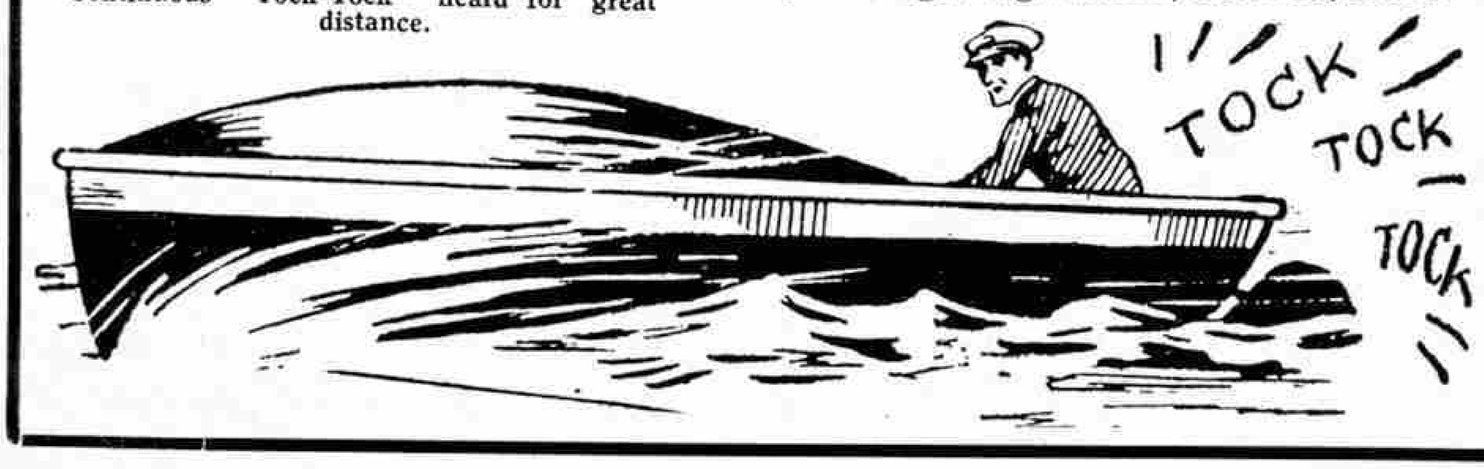
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EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL.
Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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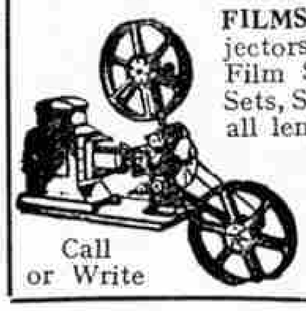
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Readers Overseas and in foreign countries may order the *Meccano Magazine* from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the case of Australia, where the price is 1/– per copy (postage extra), and the subscription rates 8/– for six months and 16/– for 12 months (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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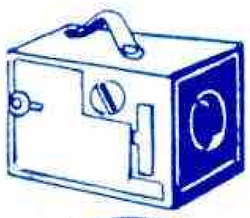
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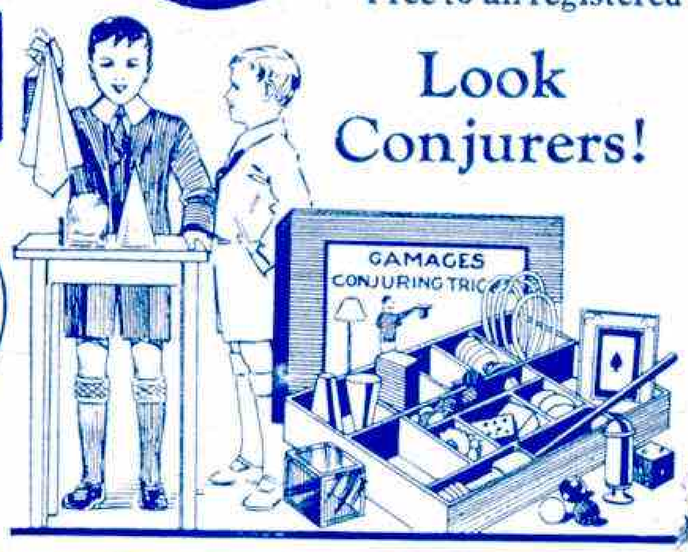


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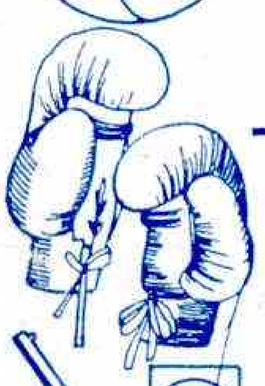
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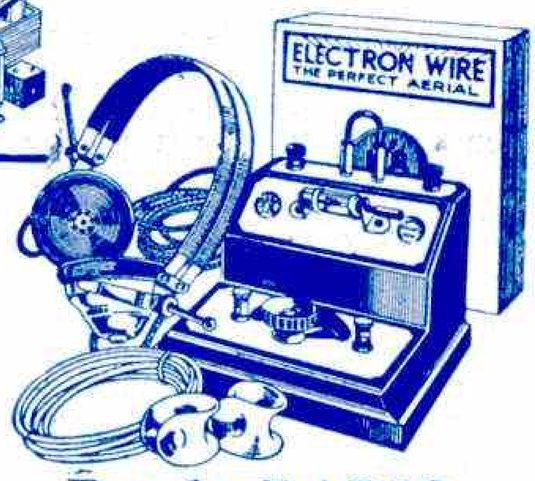
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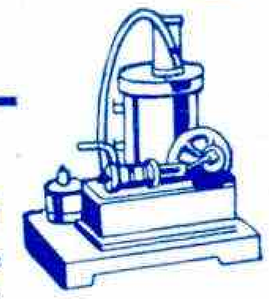




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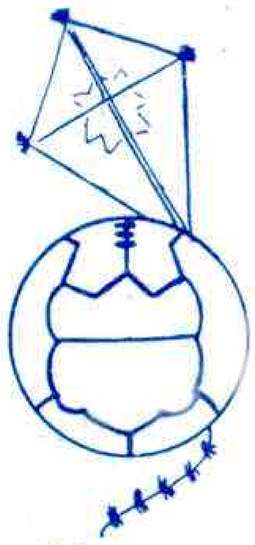
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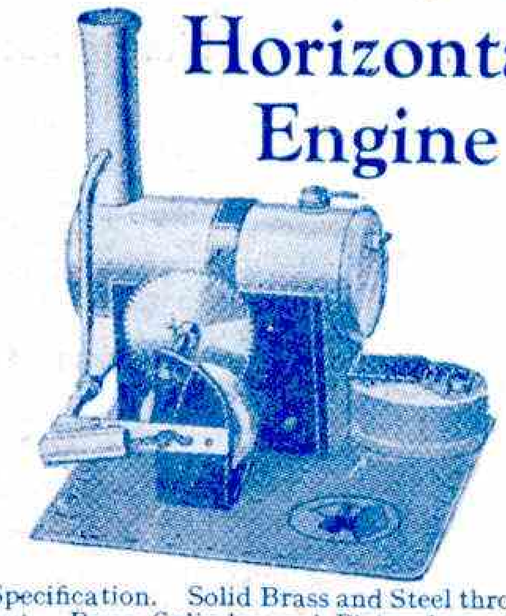
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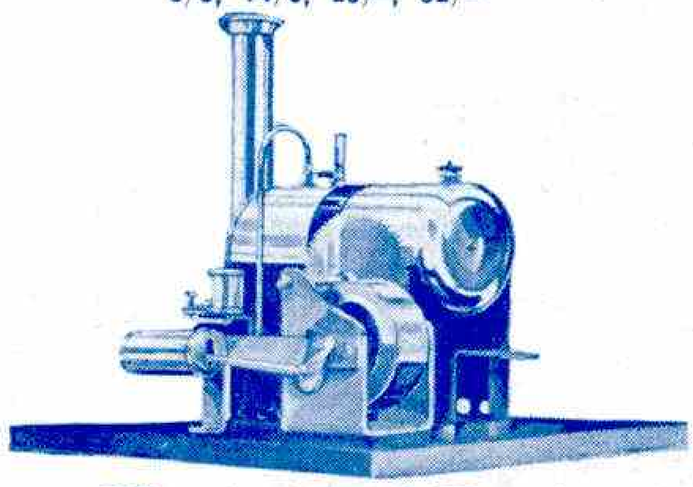
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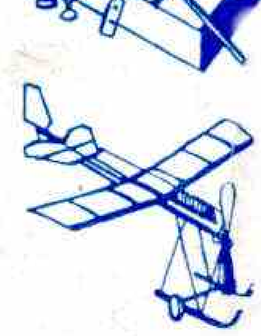
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32/6

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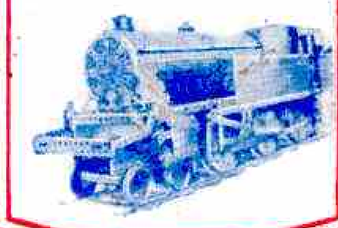


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The special Manual included with this Outfit shows how 116 splendid models can be constructed.



No. O Outfit

The Manual of Instructions included gives examples of 184 models that may be built with the Outfit.



No. 1 Outfit

This popular Outfit will be a greater favourite than ever as a result of the increased contents. Instructions for building 348 models are included.

1928 MECCANO

Double Value Outfits

Boys! we have some goods news for you! The contents of every Meccano Outfit have been greatly increased and a number of new and very valuable parts have been added, making it possible to build a large number of new models. As a result of these improvements it has been necessary to increase the prices of some of the Outfits, but we should like to emphasise that there is no comparison between the small increases in prices and the tremendously increased value of the Outfits, *e.g.*, the new No. 1 Outfit, which formerly made 136 models, now makes 348.

Particulars of the new prices are given below, and in addition we have given a table showing the number of models that each new Outfit will build as compared with the old corresponding Outfit. The number of models refer to the examples illustrated in the Manuals of Instructions only. Every Meccano boy knows that these do not exhaust the capabilities of the Outfit, however, for the number of models which may be built with each Outfit is almost incalculable.

Ask your dealer to tell you all about the latest developments.



No. 2 Outfit

This splendid Outfit builds bigger and better models than ever before. Full instructions for building 396 models are included.



No. 3 Outfit

This excellent Outfit contains many Meccano parts of an advanced engineering type and a Manual showing how to build 447 models.



No. 4 Outfit

Examples of 504 models that may be constructed are illustrated in the Manuals that are included in this Outfit.



No. 5 Outfit

Model-building possibilities are now very greatly increased with this Outfit. Examples of 547 fine engineering models are illustrated in the Manuals.

Prices of Complete Outfits

OUTFIT	NUMBER OF MODELS: Old Style	New Style	PRICE
No. 00	42	116	3/6
„ 0	67	184	5/–
„ 1	102	348	10/–
„ 2	158	396	16/–
„ 3	202	447	27/6
„ 4	255	504	50/–
„ 5 Carton	298	547	65/–
„ 5 Wood	298	547	95/–
„ 6 Carton	345	594	115/–
„ 6 Wood	345	594	150/–
„ 7	381	676	380/–

Prices of Accessory Outfits

No. 00A	1/6
„ 0A	5/6
„ 1A	7/–
„ 2A	12/6
„ 3A	23/6
„ 4A	15/–
„ 5A Carton	50/–
„ 5A Wood	80/–
„ 6A	215/–
Special Inventor's Outfit	17/6

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